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Clinical and Biochemical Profile of Children with Chronic Kidney Disease in a Tertiary Care Hospital of Bangladesh

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Abstract

Background: *Chronic kidney disease (CKD) is an insidious and irreversible condition that eventually progresses to end stage renal failure and important cause of morbidity and mortality in children worldwide. However, the care of these patients represents a challenge for health care providers, which must pay attention not only to renal disease, but also to the various extra renal manifestations that affect growth and development. Evaluation of clinical and biochemical profile of children with chronic kidney disease can help to meet up this challenge.*

Methods: *This cross-sectional observational cohort study evaluated clinical, anthropometric and biochemical variables of children with chronic kidney disease aged 2 to 16 years in the department of Pediatric Nephrology, Dhaka Shishu (Children) Hospital, Bangladesh, during July' 2018 to December' 2018. A total of thirty-six children with chronic kidney disease with creatinine clearance <60ml/min/1.73 m^2 and on supportive treatment and haemodialysis were included. In control group, equal number of age and sex matched healthy children without any preexisting chronic diseases were included. Both study group and control group were assessed for sociodemographic data, nutritional status, clinical and biochemical parameters.*

Results: *The mean age was 9.09±3.01 years in case group and 7.85±3.69 years in control group. In case group, 22 patients (61.1%) were male and 14 (38.9%) were female and the ratio was 1.5:1. In this study we found that a statistically significant decrease in Z-score for (Weight, Height and Body Mass Index) in the CKD patients' group than control. In terms of blood pressure, 66.7% of patients in the cases group were hypertensive (P = 0.001). There was no significant difference of hypertension among CKD stages in this study. CKD Patients were found anemic with significant decrease in hemoglobin level. Anemia found in 35 patients (97.2%) in the case group than control (P=0.001). CKD stage 5 children had significantly lower hemoglobin level. Serum phosphate and potassium were significantly higher while serum calcium was significantly lower and parathyroid level was higher in case group than control.*

Conclusion: *The present study stated that CKD patients had significantly lower BMI and hemoglobin but hypertensive in comparison to case group. Serum potassium, phosphate and parathyroid higher but serum calcium level was lower in case group.*

Key words: *Chronic kidney disease, Clinical, Biochemical, Child.*

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Introduction:

Chronic kidney disease (CKD) encompasses a spectrum of different pathophysiologic processes associated with abnormal kidney function and a progressive decline in glomerular filtration rate (GFR)[1]. It is an important cause of morbidity and mortality in children worldwide[1,2]. Scientific and technologic improvements during the second half of the 20th century provided renal replacement therapy as a life-sustaining option for many individuals who otherwise may have died.[2,3] In the past 2 decades, the incidence of the chronic kidney disease in children has steadily increased. The Kidney Disease Outcomes Quality Initiative (KDOQI) working group of the National Kidney Foundation (NKF) defined chronic kidney disease as evidence of structural or functional kidney abnormalities (abnormal urinalysis, imaging studies, or histology) that persist for at least 3 months, with or without a decreased glomerular filtration rate (GFR), as defined by a GFR of less than 60 mI/min per 1.73 m^2. The impact of CKD is significant. Unlike adults,

children are in formative stage of development and are particularly vulnerable to the adverse effects of CKD. Early detection and aggressive management have the potential to improve outcomes in young patients with CKD. There are multiple causes of kidney injury that lead to the final common pathway of End stage renal disease (ESRD), and this syndrome is characterized by hypertension, anemia, renal bone disease, nutritional impairment, neuropathy, impaired quality of life, and reduced life expectancy. Early stages of CKD can be detected through laboratory testing only. Along with hypertension it associated with many features like hyperkalemia, hypocalcemia, hyponatremia, anemia, hypoalbuminemia and many others. So, if we detect all these features early, we can extend the quality life of CKD patients by taking timely interventions.[4,5] This study is intended to find out these derangements for the aim to correct early to prevent the late complications.

Methods:

It was a cross sectional study done in the department of Pediatric Nephrology, Bangladesh Shishu Hospital & Institute, Dhaka, over a period of six months. Ethical approval was taken from the Institutional Ethical Review committee prior to the onset of the study. All children aged 2 to 16 years with chronic kidney disease (GFR<6Oml/min/1.73m^2) got treatment from the Department of Pediatric Nephrology was enrolled in the study. Equal number of age and sex matched healthy control were also enrolled. Children with chronic kidney disease getting treatment or follow up, who fulfilled the inclusion criteria were enrolled in the study. The purpose of the study was explained to all parents and patients. They were then approached for participation either in the inpatient or outpatient setting after taking informed written consent or assent. Demographic data regarding information about age, relationship of respondent to child, parental education status and socio-economic status were collected from guardian or parents. Medical data regarding diagnosis, recent biochemical parameters, treatment status, follow up were obtained from the patient's medical record. All findings were noted and recorded in a questionnaire. The data from patients was collected on a proforma. Data was collected by preformed questionnaires and then processed and analyzed by using the SPSS Windows (version 20.0) programs. P value < 0.05 was considered statistically significant. Certificate from the institutional ethical review committee (IRC) of Bangladesh Shishu Hospital & Institute was obtained for the study.

Results:

This cross-sectional study was carried out with an aim to determine the clinical and biochemical parameters of children with CKD. A total of 36 children age ranged from 2-16 year with chronic kidney disease and equal number of age and sex matched control were included in this study.

Table shows the average age was 9.09±3.01 years in case group and 7.85±3.69 years in control group. Male Female ratio in case is 1.5:1 vs 0.8:1 in control. Most of the study cases 61.1% vs 86.1% control were from rural. In socio-economic status 25% were from poor socioeconomic, 47.2% were from lower middle socioeconomic class in cases group, on the other hand 19.4% were from poor socioeconomic class, 72.2% were from lower middle socioeconomic class in control group. In case group, 44.4% father were businessman & 91.7% mother were housewife whereas 94.4% mother in control group were housewife. In both case and control groups 25% were non immunized.

Table shows higher percentage of stage 3 in 2-5 years (100%) and higher percentage of stage 5 in 5-10 years (46.7%). The difference was statistically significant between stage and age group (P=0.010).

Table shows in WAZ 52.8% of case were <3rd percentile, 30.6% were 3rd -50th percentile and 16.7% >50th percentile on the other hand in control 2.8%, 36.1% and 61.1% respectively (p= .001). In HAZ 55.6% case were <3rd percentile 30.6% 3rd -50th percentile and 13.9% were >50th percentile but in control group it was 13.9%, 47.2% and 38.9% respectively (p= .001). BMI shows 88.9% of case were underweight and 11.1% were within normal weight and 30.6% control were underweight and 69.4% were within normal weight which is also statistically significant.

Table shows 33.3% cases were normotensive and 63.9% had stage 2 hypertension but all were normotensive in control group. The difference is statistically significant between two groups (P=0.001).

Table shows statistically significant difference in hemoglobin and serum parathyroid level between stage 3,4,5. Hemoglobin level is significantly low and parathyroid hormone is high in stage 5 CKD.

Table-I

Demographic characteristics of case and control (n=72)

Characteristics	Case (n=36)		Control (n=36)		P value
Mean age (years ±SD)	9.09±3.01		7.85±3.69		0.122
Range	3-14		3-14		
Sex					
Male	22	61.1	16	44.4	0.157
Female	14	38.9	20	55.6	
Male: Female	1.5:1		0.8:1		
Residence					
Rural	22	61.1	31	86.1	0.031
Urban	12	33.3	3	8.3	
Urban slum	2	5.6	2	5.6	
Socio-economic					
Poor	9	25.0	7	19.4	0.093
Lower middle	17	47.2	26	72.2	
Upper middle	8	22.2	3	8.3	
Father occupation					
Service holder	6	16.7	5	13.9	0.084
Businessman	16	44.4	8	22.2	
Others: (Farmers, Shopkeeper)	14	38.9	23	63.9	
Mother's occupation					
House wife	33	91.7	34	94.4	0.643
Service holder	3	8.3	2	5.6	
Immunized status					
Immunized	22	61.1	25	69.4	0.478
Partially immunized	5	13.9	2	5.6	
Non immunized	9	25.0	9	25.0	

P value reached from chi square test

Table-II

Age distribution of study patients according to stage of CKD (n=36)

Age group (Year)	Number	Stage 3		Stage 4		Stage 5		P value
		No	%	No	%	No	%	
2-5	6	2	100	0	00	4	13.3	0.010
5-10	16	0	00	2	50.0	14	46.7	
10-16	14	0	00	2	50.0	12	40.0	

P value reached from chi square test

Table-III

Anthropometry of study patients and control (n=72)

Anthropometry	Case (n=36)		Control (n=36)		P value
	No	%	No	%	
WAZ					
<3rd percentile	19	52.8	1	2.8	0.001
3rd -50th percentile	11	30.6	13	36.1	
>50th percentile	6	16.7	22	61.1	
HAZ					
<3rd percentile	20	55.6	5	13.9	0.001
3rd -50th percentile	11	30.6	17	47.2	
>50th percentile	5	13.9	14	38.9	
BMI					
Under weight (<18.5)	32	88.9	11	30.6	0.001
Normal (18.5-24.9)	4	11.1	25	69.4	
Overweight (25 -29.9)	0	00	0	00	
>Obese (>30)	0	00	0	00	

P value reached from chi square test

Table-IV

Blood pressure values between case and control (n=72)

Blood pressure	Case (n=36)		Control(n=36)		P value
	No	%	No	%	
Normotensive	12	33.3	36	100	0.001
Stage 1 HTN	1	2.8	0	00	
Stage 2 HTN	23	63.9	0	00	

P value reached from chi square test

Table-V

Hematological & biochemical features of different stages of CKD (n=36)

Parameters	Stage 3Mean±SD	Stage 4Mean±SD	Stage 5 Mean±SD	P value
Hb% (g/dl)	11.00±2.12	9.20±1.43	7.34±1.22	0.001
Serum K+ (mmol/L)	4.50±0.42	4.40±0.27	5.35±0.922	0.074
Serum calcium (mmol/L)	2.10±0.28	2.12±0.22	2.00±0.23	0.554
Serum phosphate (mmol/L)	2.10±0.0	2.12±0.18	2.44±0.40	0.07
Serum PTH (pg/ml)	275.50±62.93	611.00±369.80	845.26±546.59	0.027

P value reached from anova test

Discussion:

This cross-sectional study was carried out with an aim to determine the socio demographical and biochemical parameters in different stages of CKD in children in a tertiary care hospital in Bangladesh. A total of 36 children age ranged from 2-16 year with chronic kidney disease receiving treatment from the Department of Pediatric Nephrology, Dhaka Shishu Hospital and equal number to age and sex matched control were included in this study. The present study findings were discussed and

compared with previously published relevant studies

The present study showed that average age was 9.09±3.01 years (mean±SD) in case group and average age was 7.85±3.69 years (mean±SD) in control group similar to Hafiz I.N. et al[6] where average age 9.88±3.92 years in case vs 10.72±2.88 years in control. The findings of the study are in well agreement with the findings of the other research works (Al-Doori et al.)[7]

In this study, 22 patients (61.1%) in the case group were male and 14 cases (38.9%) were female and ratio was 1.5:1. However, these consistent results obtained in other studies, like Harambat et al. [10] where the higher prevalence of CKD in males. Another study Al-Doori et al. found 19 patients (47.5%) in the cases group were male and 21 cases (52.5%) were female which was not similar.

In the present study we found that a statistically significant decrease in Z-score for (Weight, Height and BMI) in the CKD patients' group than control. Our study was in agreement with Hafiz I.N. et al. found that there was growth deficit in anthropometric parameters in dialysis children compared to healthy control.

In terms of blood pressure, 66.7% of patients in the cases group were hypertensive (P = 0.001), though other studies show a similar prevalence Mukesh L. et al.[11] found 37.1% cases were hypertensive which was contrary with our results. Many factors contribute to the raised incidence of hypertension in CKD patients. They include sodium retention, increased activity of the renin-angiotensin-aldosterone system, an exaggerated activity of the sympathetic nervous system, secondary hyperparathyroidism, deficient nitric oxide and endothelium-mediated vasodilation. Kale et al. [16] had found that hypertension was identified as important risk factor for all three LV disorder (LVH, diastolic & systolic dysfunction). Systolic, diastolic and mean BP was separately and significantly associated with LV disease.[17] There was no significant difference of hypertension among CKD stages in this study.

In the present study, the CKD Patients were anemic with significant decrease in hemoglobin level. Anemia found in 35 patients (97.2%) in the case group than control (P=0.001), in agreement with our results Mukesh L. et al. who found that CKD patients (patients vs controls) presented with anemia with significant low Hb (9.1 gm/dL vs 12.04 gm/dL) with P value <0.001. In this study there was statistically significant difference in hemoglobin level among different stages of CKD (P = .001). CKD stage 5 children had significantly lower hemoglobin level.

In the present study, serum phosphate and potassium were significantly higher while serum calcium was significantly lower and parathyroid level was higher in case group than control. This finding in concordance with Ali et al.[18] who reported the same results. But in present study hyperkalemia, hypocalcemia, hyperphosphatemia, all these derangements were not statistically significant between stages except hyperparathyroidism. Serum parathyroid hormone was significantly higher in CKD stage 5 children. In hemodialysis patients disturbed phosphate –calcium metabolism may increase serum parathyroid hormone which may stimulate inflammatory markers, interleukin-6 production in hemodialysis patients that contribute to cardiovascular morbidity and mortality by vascular calcification.

Conclusion:

Anemia, hypertension along with hyperkalemia, hyperphosphatemia, hypocalcemia are most common findings in CKD children. Serum parathyroid significantly higher in CKD stage 5.

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