

Immediate Outcome of Childhood Chronic Kidney Disease in a Tertiary Care Hospital, Bangladesh

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Abstract

Background: Prognosis of advance CKD is unfavorable in children, especially in low and low middle-income countries. This study was conducted to find out the nature of presentations and the immediate outcome of pediatric CKD.

Method: This longitudinal study was done from October 2018 to November 2019 in the Paediatric Nephrology Department of Dhaka Shishu (children) hospital in children of 6 months to 18 years of age with CKD. The demography, etiology, clinical presentation, immediate outcome was observed and followed for 6 months after initial presentation. We classified the outcomes as death and improved. Bivariate analysis was conducted. We calculated risk ratio (RR) and 95% confidence interval (95% CI) between the outcome and risk factors.

Result: Out of 62 children, 38% were in 5-10 years age group. Stages of CKD at diagnosis were Stage V (41%), Stage IV (12%), Stage III (7%) and Stage II (2%). Commonest (44%) underlying cause of CKD were Congenital Anomaly of Kidney and Urinary tract (CAKUT). After 6 months, 32 (52%) patients were lost to follow up, 21 (33%) patients improved and 9 (14%) patients died. On bivariate analysis, male child (RR:3.5, 95%CI: 1.3, 9.2) and poor socioeconomic status (RR:3.1, 95%CI: 1.6-5.9) were significantly associated with death in CKD.

Conclusion: This longitudinal study found male CKD child and patients having poor socioeconomic condition were the risk factors for poor outcome. We recommend to conduct a cohort study with better follow up to find out the risk factors for poor outcome of CKD patients.

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Introduction

Chronic kidney disease (CKD) is the leading cause of global mortality that adversely affects the quality of life, cardiovascular status and add a substantial burden on health care systems.¹ 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 ml/min per 1.73 m².²

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The precise nationwide prevalence of CKD is still unknown in Bangladesh. However, in a few studies, the estimated prevalence was between 17% to 19%.³ With the growing prevalence of CKD worldwide, it sequentially affects the children also. The number of childhood CKD was rising steadily within the past two decades. The exact burden of CKD in children in most developing countries is unknown and difficult to estimate due to the lack of data on pediatric kidney disease. Few hospital-based studies exist with a variable reported pattern of renal disease in the pediatric population. Although the prevalence of CKD in children is relatively low, it presents significant therapeutic challenges by dealing with multiple extrarenal comorbid conditions.⁴

CKD in children has the faster risk for developing ESRD- where the patient needs renal replacement therapy for long time survival and results in high mortality rate.⁵ Few data of childhood CKD showed variable rate of progression depending upon some modifiable risk factors.⁶ The true burden of ESRD is not known. Over 90% of patients requiring RRT in India are die because of inability to afford care, and even in those who can start RRT, 60% stop due to financial reasons.⁷ It is evident in many studies that mortality rate of ESRD children are 30 to 150 times higher than children without ESRD.^{8,9} The choice of renal replacement therapy is confined to renal transplantation and chronic dialysis in the form of chronic hemodialysis (HD) or continuous ambulatory peritoneal dialysis (CAPD). The facility to provide renal replacement therapy (RRT) in ESRD patient is limited in Bangladesh due to various factors. The lack of health insurance scheme and absence of national ESRD registry program make the cost of RRT beyond of reach for majority of the population. In addition to that, renal transplantation which is

undoubtedly a best option for ESRD in children are performed in only about 0.2% in children of Bangladesh due to lack of expertise center with skilled team for transplantation.³

Among many factors delayed diagnosis, scarcity of centers providing RRT, frequent catastrophic healthcare expenditure, high expense of RRT have been associated with discontinuation of dialysis and finally causes death. Premature discontinuation of treatment occurs during all stages of CKD, but is particularly frequent (40 – 50%) in children requiring RRT.⁹ In a retrospective study in India, it was found that almost half of all patients with ESRD discontinued treatment despite the availability of maintenance dialysis services.^{10,11} However, the dreadful outcome of CKD is differing in developed and developing countries. In low and low middle-income countries, the mortality rates of pediatric CKD are assumed to be high.¹¹ This study was aim to provide data about the nature of presentation of childhood CKD patients in a leading tertiary hospital in Bangladesh, providing advance Paediatric Nephrology services and find out their immediate outcome.

Methods

This prospective study was conducted among the Children between 6 months to 18 year attending in Dhaka Shishu (children) hospital in the Department of Pediatric nephrology with a diagnosis of CKD based on (KDOQI) criteria, between October 2018 to November 2019. Child less than 6 months and patients whose attendant denied to give consent were excluded from the study.

Patients history including demographic history, age of presentation, native kidney disease all were taken from the parents. Patients staging of CKD, nature of

presentation, presenting co morbidities, and outcome were observed. After discharge patient were monitored over phone or in follow up visit routinely at 3months interval. Final follow up was given after 6 month of hospital discharge to see their immediate outcome.

CKD was defined as GFR < 60 ml/min/1.73 m² over a period of more than three months. CKD Dialysis dependent/End Stage Renal Disease was defined as GFR less than or equal

to 15 ml/min/1.73 m² body surface area and dialysis dependent. CKD non dialysis dependent was defined as GFR < 60ml/min/1.73 m² and including GFR < 15 ml/min/1.73 m² but not dialysis dependent. eGFR was estimated glomerular Filtration rate was calculated by using Haycock-Schwartz formula

$K \times \text{height (cm)} / \text{Serum Cr (mg/dl)} [K=0.413]^{11}$

CKD Staging according to KDOQI

Stages of chronic kidney disease:

Stage	GFR ml/min/1.73m ²	Description
1	90	Kidney damage with normal or increased GFR
2	60-89	Kidney damage with mild reduction of GFR
3	30-59	Moderate reduction of GFR
4	15-29	Severe reduction of GFR
5	<15	Kidney failure
5D	<15 on dialysis	Kidney failure, dialysis dependent

Data analysis

We performed descriptive analysis of the demographic and socioeconomic variables. We divided the outcome of the CKD patients as improved whose general condition improved during follow up and death who died during follow up. We performed bivariate analysis of the the factors with the outcome. We calculated risk ratio and 95% confidence interval. We set p<0.05 as level of significant.

Results

A total of 62 children with chronic kidney disease receiving treatment from the Department of Pediatric Nephrology of Dhaka Shishu (Children) Hospital, Dhaka was included in this study. In the study population, the commonest age group belongs to in a range of 6 -10 years (45%) with a mean age of 7.4±4.1 year. Male to female ratio were 1:0.8. Majority 89% of the patients were belonging to poor and lower middle socio economic back ground. Most of the CKD

patients 41 (66.1%) were at stage 5. Among the patient of CKD stage 5, 31 were dialysis dependent (CKD 5D) and the rest 10 were not dependent on dialysis during the onset of the study. Other patients were belonging to CKD stage 4- 12 (19.3%), CKD stage 3- 7 (11.2%) and the rest of the 2 patients at CKD stage 2 (6.4%). At the time of recruitment out of 62 patient, 48 (77.4%) were newly diagnosed CKD and 17(27.4%) presented on acute crisis state. The study patients presenting comorbidities were due to septicemia 22.5%, cardiac complications 19.3%, hypertensive encephalopathy 16.1%, metabolic complications 16%, severe anemia 11.5%, uremia 9.6% and shock 8%. (Table I) According to the underlying kidney disease of CKD, non-glomerular causes 51.6% were predominant than glomerular causes 26%. Among the non-glomerular causes Congenital anomaly of kidney and urinary tract (CAKUT) constitute 44% which was the commonest cause and consisting of obstructive uropathy 22.5%, reflux

nephropathy 8% and hypoplastic/dysplastic kidney 13%. Neurogenic bladder is another important cause of non- glomerular CKD 8%. Among the hereditary causes cystic renal disease constitute 4.8% cases of CKD and one patient had oxalosis. Miscellaneous group 4% includes chronic tubulopathy and other tubulo interstitial disorder. However, large group of patients 13% were detected CKD with unknown etiology. (Table II)

Mortality rate of CKD patient in advance stage was high 21(33.8%), which was 10

(16%) at the onset of study during hospitalization and became 11 (21%) following discharge from hospital within 6 months. During hospital course 11 (17%) of patients were discontinued treatment, however after 6 month of follow up 18 (29%) of patients were discontinued treatment or lost to follow. At follow up in hospital, 38(61.2%) patients were improved, while after 6 months of follow up 23 (37.09%) of patients were improve. (Table III).

Table I: Base line Characteristics of study CKD patients admitted in Dhaka Shishu Hospital from October 2018 to November 2019

Variable	Number (%)
Age in year	
0-5	18 (29)
6-10	28 (45)
>10	16 (25)
Gender	
Male	34 (54)
Female	28(45)
Socio Economic status	
Poor	17(27)
Lower middle	38 (62)
Upper middle	7 (11.2)
Higher	0
Staging of CKD	
Stage 1	0
Stage 2	2(6.4)
Stage3	7(11.2)
Stage 4	12(19.3)
Stage5	10(16)
Stage 5D	31(50)
Duration of CKD (year) Mean±SD	1.2 ±0.35
BMI (kg/m2) Mean ±SD	13.7±0.65
Nature of presentation	
Acute on Chronic CKD	17(27.4)
New onset CKD	48(77.4)
Presenting Co morbidities during admission	
Severe Anemia	7(11.2)
Hypertensive encephalopathy/crisis	10(16.1)
Uremia	6(9.6)
Sepsis /urosepsis	14(22.5)
Heart failure/ cardiomyopathy	12(19.3)
Shock	5(8)
Hypocalcemia	3(4.8)
Metabolic acidosis	7(11.2)
Others	10(16)

Among multiple factors the primary reason for death (n =21) according to attendees of patient's were attributes to

1. Discontinuation of treatment / dialysis - 10 (47.6%)
2. Complicated disease course – 7(33.3%)
3. Late referral- 3(14.3%)

Table II: Distribution of patients according to Native kidney disease admitted in Dhaka Shishu Hospital from October 2018 to November 2019

Native kidney disease	Number (n)	Percentage (%)
Glomerular cause	16	26
SRNS/FSGS	8	13
IgA	2	3.2
SLE	1	1.6
Crescentic GN	2	3.2
Atypical HUS	3	4.8
Non glomerular causes	32	51.6
Obstructive Uropathy	14	22.5
Renal hypoplasia/dysplasia	8	13
Reflux nephropathy	5	8
Neurogenic bladder	5	8
Hereditary renal disease	4	6.4
Oxalosis	1	1.6
Cystic kidney disease	3	4.8
Miscellaneous	2	3.2
Undetermined etiology	8	13
Total	62	100

Table III: Hospital outcome of CKD patients and their immediate outcome after 6 months of hospitalization.

Variable	Hospital outcome n (%)	Final outcome (%)
Death	10 (16.1)	21(33.8)
Discontinue treatment/lost to follow	11(17.7)	18(29.0)
Improving	38(61.2)	23(37.09)

Table IV: Factors affecting Final outcome of CKD patient admitted in Dhaka Shishu Hospital from October 2018 to November 2019

Outcome of CKD Patients	Death	Remaining/existing patients	Prevalence Odd's Ratio	95% Confidence interval
Age of the patient				
≤5 years	6	12	0.98	0.46, 2.1
> 5 years	15	29		
Gender				
Male	17	17	3.5	1.3, 9.2
Female	4	24		
Socio economic status				
Poor	13	4	3.1	1.6, 5.9
Middle and High	8	37		
BMI				
<12	12	25	0.9	0.4, 1.8
≥12	9	16		
Duration of disease				
> 1 years	5	7	1.3	0.6, 2.8
≤ 1 years	16	34		
Nature of presentation				
Acute on Chronic CKD	5	12	0.88	0.3, 2.0
New onset CKD /ESRD	16	29		
Cause of CKD				
Glomerular Cause	8	8	0.8	0.2, 3.2
Non-Glomerular Cause	13	33		
Dialysis				
Dialysis dependent	18	13	1.3	0.4, 4.3
Dialysis nondependent	6	25		

Discussion

This study revealed that common reason for childhood CKD was CAKUT, who came across medical attention at advance stage followed by early fatal outcome. In this study the common age group belongs to in a range of 5 -10 years. Few other studies had shown similar results.¹² In the current study, the proportion of male patients was predominant to that of female patients. The probable causes attribute to obstructive uropathy which is the leading etiology of CKD and commonly

found in male children. A number of studies showed male predominance.¹³⁻¹⁶

The current study revealed the commonest causes of CKD was CAKUT which constitute about 44%, whereas, FSGS were more common among the glomerular cause. This similar picture of etiology was seen in a study done in India by Kamath et al.¹⁷ Few other studies also showed same findings.¹⁸⁻²⁰ However different result was found by the Australia and New Zealand Dialysis and

Transplant registry who reported glomerulonephritis was the most common cause of end stage renal failure in children and adolescents.²¹

It was observed that majority of the children presented with advance stage in CKD V, which was alike to many studies.^{22,17} The cause of the large burden of CKD V was probably due to delayed referral into renal center and ignorance of the symptoms by the family. Mortality rate among our study was estimated to be approximately 33.4%. The mortality rate and final outcome of CKD is closely related to the economic situation of the studied population and their access to health care resources. This figure varied in different geographical regions and ethnicities. Ali et al reported a 23.4% mortality rate in children with CKD in Sudanese population while it was reported to be 8.3% in Saudi Arabia.¹⁴⁻¹⁶ In a study done in Africa, had noticed a very high mortality rate 90% in untreated pediatric ESRD children.²³

Male gender has a role to progression of CKD was observed in this study. Though the causes is not clearly understood, many studies in adult noticed the effect of reno protection in female than in male. Hormonal influence may play a significant role in these aspects. In this study large number of CAKUT which predominantly occurred in male may adding some bias in this male predominance.

In current study it was observed that, outcome of CKD significantly affected by poor socioeconomic status. This finding assumed that poor socioeconomic status correlated significantly with death of the CKD patient. Other study done in India showed that premature discontinuation of ESRD care was associated with greater travel distances, delayed diagnosis of CKD and low family socioeconomic status.^{8,24} Moreover, Shroff et

al. noted a 7.5-fold increase in mortality risk among patients with concomitant external diseases.²⁵

This study is a single center study and time frame was short to describe outcome. In addition, the outcome estimates in the study are based on observational follow up which may influence the study result. However, this study highlights the immediate poor outcome of advance childhood CKD, which helps the health researcher and policy maker to take necessary steps for the early detection of CKD and provide logistic financial support to prevent premature discontinuation of treatment.

Conclusion

The current study revealed that commonest cause of childhood CKD belongs to CAKUT. The children with CKD seek medical attention at very late stage. In advance stage mortality rate with CKD is very high and discontinuation of treatment plays a critical role behind the scene.

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