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ROLE OF RENAL PARAMETERS IN ASSESSMENT OF RENAL IMPAIRMENT IN CKD PATIENTS

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ABSTRACT

Aim & objectives: To study the role ultrasonographic renal parameters to assess renal impairment in CKD patients.

Method: Total 86 patients with CKD were undergone ultrasonographic examination for evaluation kidneys. Renal length, cortical thickness, segmental artery Doppler and cortical echogenicity were documented on B-mode gray scale using 2-5 MHz probe.

Results: Mean renal length was 8.12cm, mean cortical thickness was 6.25mm and mean eGFR was 43.27 ml/min/1.73m^2. Serum-creatinine showed negative correlation with cortical thickness and renal length. eGFR showed positive correlation with cortical thickness and renal length. Cortical echogenicity positively correlated with serum creatinine (r=0.7102, P<0.01) and negatively with renal function (r=-0.4681, P<0.01). RRI was higher in advanced stages of CKD.

Conclusion: Cortical thickness and cortical echogenicity showed significant correlation with serum creatinine and renal function. RRI can be used as marker in CKD and to assess the risk of adverse renal outcome in CKD.

KEYWORDS : CKD, Cortical Thickness, Renal Length, Cortical Echogenicity, Serum Creatinine And eGFR, RRI.

INTRODUCTION

Chronic kidney disease (CKD) worldwide health problem causing progressive decline in renal function. Higher prevalence of CKD is due to obesity, hypertension diabetes etc. On ultrasonography, cortical echogenicity is also increased with progression of disease, and is due to interstitial inflammation, oedema, sclerosis or fibrosis. Previous studies have suggested that progressive decrease in renal length and cortical thickness could predict possibility of renal failure later in course of disease[1]. The resistive index (RRI) is commonly used as an index of intrarenal arterial resistance caused by various intrarenal pathologies. RRI increases in various kidney diseases including CKD. Some previous studies have shown the associations of RI with renal function and patient prognosis. Therefore, we planned to study the relationship between ultrasonographic renal parameters and renal impairment in patients with chronic kidney disease.

AIMS AND OBJECTIVES

To assess the role of renal resistive index, renal cortical thickness, renal length, and cortical echogenicity in CKD patient.

MATERIAL AND METHOD

It was hospital based cross-sectional study conducted in department of Radiodiagnosis, MGM Medical College, Indore, after getting approval from Institutional Scientific Review Board. A total of 86 patients with CKD, age more than 18 years were undergone ultrasonographic examination for kidney evaluation in B-mode grey scale using 2.5 to 5 MHz transducer after taking written consent. Bipolar renal length, cortical thickness and renal resistive index (RRI) were measured. Documentation of cortical echogenicity was done by comparing with liver echogenicity. A detailed clinical history, serum creatinine and eGFR using Cockroft-Gualt equation were recorded. Exclusion criteria: congenital renal diseases, acute kidney disease, renal malignancy, traumatic injury; and unwilling patients to consent for study were excluded. Appropriate statistical tests were applied for renal cortical thickness, renal length, cortical echogenicity, renal resistive index and eGFR values. Pearson correlation analysis was done between renal length and renal cortical thickness measurements against serum creatinine and eGFR. P-values of <0.05 was considered to be statistically significant.

RESULTS & DISCUSSION

Out of total 86 CKD patients, 48 were male and 38 were females. In our study, age range was 18-82 year, with mean age 53.11 years. Common age group was 45-55 years (40%).

The mean serum creatinine was 4.02mg/dl. The mean eGFR was 43.27 ml/min/1.73m2. These results were correlated with the studies done by Siddappa JK et al in 2013[2]. The mean bipolar renal length in CKD patients was 8.12cm. The mean renal cortical thickness in CKD patients was 6.25 mm (Table 1)[1].

78 out of 86 patients with CKD had increased cortical echogenicity. Majority of them had grade 2 cortical echogenicity (36). 48 patient out of 86 patients had maintained corticomedullary differentiation, 29 patients had poorly maintained CMD and 9 patients had lost CMD on ultrasonography. The results were in concordance with study conducted by Singh A et al in 2016[4].

In our study, serum creatinine was significantly higher in higher grades of echogenicity (P< 0.01) and mean eGFR was also significantly decreased with increasing grades of echogenicity (Table 2). These findings were consistent with the findings of Siddappa JK et al (2013)[2].

In our study, bipolar renal length and cortical thickness were decreased significantly with increasing grades of cortical echogenicity in CKD patients (P<0.01) (Table 2). Our results were in accordance with study by Ahmed S et al (2019)[5]. The mean renal resistive index (RRI) was 0.92 in our study. It was significantly higher in higher grades of increased cortical echogenicity (P=0.024) and also in advanced stages of CKD (P<0.01) (Table 2). Thus RRI had increased with progression of disease and it was well correlated with renal function (Table 3 & Figure 3). Our findings were in accordance with study done by Hanamura K et al 2012[9].

In our study, serum creatinine showed significant negative correlation with cortical thickness (r=-0.6504, P<0.01), renal length (r=-0.3745, P<0.05) and cortical echogenicity (r=0.7102, P<0.01). The renal function (eGFR) was positively correlated with cortical thickness (r=0.5781, P<0.01), renal length (r=0.3248, P<0.01) and negatively with cortical echogenicity (r=-0.4681, P<0.01). Thus, in our study, cortical thickness was more strongly related to serum creatinine and eGFR (Table 3). These findings were in concordance with results of Yamashita SR et al (2015)[3]. This correlation between serum creatinine and eGFR with cortical echogenicity can be explained by the fact that echogenicity of kidneys was due to glomerular sclerosis, tubular atrophy interstitial fibrosis and inflammation[6]. These findings, on biopsy, were clinically associated with decreased renal function thereby decreasing eGFR and higher serum creatinine level. These findings were further supported by Moghazi S et al (2005)[7] and Gareeballah et al (2015)[8].

Table 1: Mean values of renal parameters in CKD patients:

Parameters	Mean
1.Serum creatinine (mg/dl)	4.02
2.eGFR (ml/min/1.73m2)	43.27
3.Cortical thickness (mm)	6.25
4.Renal length (cm)	8.12
5.Renal resistive index (RRI)	0.92

Table 2: Comparison of various parameters according to grades of cortical echogenicity in CKD patients:

	Serum Creatinine (mg/dl)	eGFR (ml/min/1.73 m2)	Renal length (cm)	Cortical thickness (mm)	RRI
Echogenicity	Mean	Mean	Mean	Mean	
Grade 0	1.45	66.41	12.54	11.86	0.73
Grade 1	1.96	45.78	10.78	9.75	0.81
Grade 2	3.24	28.75	8.81	7.31	0.89
Grade 3	4.87	21.63	7.27	5.68	0.93
Grade 4	6.91	15.65	6.68	3.46	0.98
P-value	<0.01	<0.01	<0.05	<0.01	0.024

Table3: Statistical correlation of serum creatinine and eGFR with renal parameters in CKD patients:

Renal Parameters	Serum creatinine		eGFR	
	Correlation (r)	P-value	Correlation (r)	P-value
Cortical thickness	-0.6504	<0.01	0.5781	<0.01
Renal length	0.3745	<0.01	0.3248	<0.01
Echogenicity	0.7102	<0.01	-0.4681	<0.01
RRI	0.4321	0.038	-0.5017	0.041

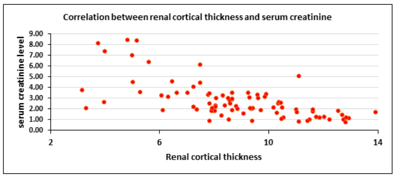

Figure 1: Scatter plot showing relationship between cortical thickness and serum creatinine:

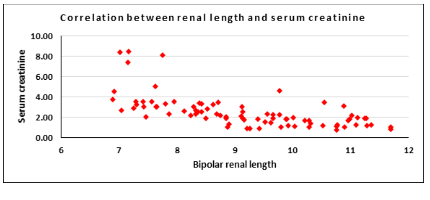

Figure 2: Scatter plot showing relationship between renal length and serum creatinine:

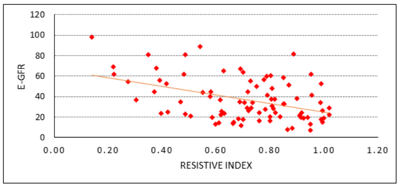

Figure 3: Scatter plot showing relationship between eGFR and Resistive index.

CONCLUSION

Finally, we conclude that, ultrasonographic renal parameters such as renal cortical thickness, renal length and cortical echogenicity were well correlated with serum creatinine and renal function (eGFR) in CKD patients. Cortical thickness and cortical echogenicity had shown strong correlation with serum creatinine and renal function. These parameters can be used to assess the status of renal function and for follow-up to predict the progression of disease over the time in patients with CKD. RRI was significantly higher in CKD patients and was more in advanced stages of CKD. Therefore, it can be used as marker in CKD and as a risk factors for adverse renal outcome in CKD.

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