

# Importance of ultrasound evaluation of renal cortical and renal length as a predictor of renal function impairment in chronic renal disease patients by comparing them with changes in eGFR

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## Abstract

**Aims and objectives:** To determine whether a linear corelationship exists between laboratory findings such as creatinine/ estimated glomerular filtration rates and renal length and cortical thickness in patients with chronic kidney disease (CKD). **Materials and methods:** Ultrasound and laboratory data such as serum creatinine/ estimated glomerular filtration rates and renal cortical thickness and length from 40 patients with CKD was collected for analysis. Of these 26 were a prospective group who were followed over a period of one and a half years with a biannual USG and quarterly laboratory blood test. Data from rest of the 14 patients was from a retrospective analysis of previous records. All patients were in the age group of 30 to 70. Patients who were candidates for renal transplant, with renal calculi and hydronephrosis were not included. eGFR was calculated using the Modification of diet in Renal Disease Study(MDRD) equation. Cortical thickness was measured in sagital plane over a medullary pyramid perpendicular to the capsule. Renal cortical thickness, renal length and estimated glomerular filtration rate were compared. Pearson correlation analysis was done between renal length and cortical thickness and eGFR values. **Conclusion:** At the beginning of the study and after one and half years i.e at the end, the mean eGFR was 35.91 and 28.41ml/min respectively. The mean renal length was 91.18mm and 90.13mm respectively. The mean Cortical thickness was 5.66mm and 5.18mm respectively A statically positive relationship was found between eGFR and mean renal length ( $r=0.68, p \leq .01$ ) and between GFR and mean Cortical thickness  $r=0.89, P \leq 0.01$ . Our study suggests that Renal Cortical thickness measurements on ultrasonographic analysis is an important imaging technique in follow up of CKD patients.

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Received Date: 06/03/2020 Revised Date: 13/04/2020 Accepted Date: 17/05/2020

DOI: <https://doi.org/10.26611/10131637>

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	Accessed Date: 28 December 2020

## INTRODUCTION

The prevalence of chronic kidney disease (CKD) has increased worldwide because of the growing numbers of cases of diabetes, hypertension, and obesity, in addition to the aging of the general population. Once diagnosed, CKD patients are continuously monitored for progression of disease by serum Creatinine levels, estimated GFR and 24 hr Creatinine clearance levels. Sonography is a simple, cost effective, and non-invasive method performed in all patients with CKD, which helps in etiological diagnosis and in monitoring progress of the disease. Important Sonographic features are echogenicity, renal length,

parenchymal thickness and CORTICAL thickness. Size of the kidney is a key parameter and a decrease in volume over a period corresponds more closely to decrease in function, but it is generally difficult to measure because of kidneys ellipsoid shape. Recent studies suggests that progressive decrease in the cortical thickness might be an early sign of renal failure.

**AIMS AND OBJECTIVES**

Present study aims to show the correlation between eGFR and Ultrasound parameters of cortical thickness and renal length in patients receiving follow-up care for CKD

**MATERIAL AND METHOD**

Present study included data of 40 patients with confirmed diagnosis of CKD, undergoing clinical follow-up with serum Creatinine, GFR and 24 hr Creatinine clearance levels. Prospective study of 40 patients (24 males and 16 females) diagnosed as CKD- followed over a period of one and half yrs ( Jan 2018 to Aug 2019) in Kamineni institute of medical sciences with a biannual sonography and quaterly blood examinations of serum Cr. and eGFR

**Inclusion criteria:** Age 30 to 70 yrs with a confirmed diagnosis of CKD satisfying the exclusion criteria.

**Exclusion criteria:**

- Polycystic kidney disease
- Moderate to severe hydronephrosis and renal calculi
- Obstructive nephropathy
- Malignancies and tumors and associated end stage cardiac ,hepatic and pulmonory conditions.

**Method:**

- Initial investigations included
  - CBP
  - complete urinalysis, urine albumin
  - blood electrolytes
  - liver enzymes
  - serum creatinine, GFR, 24 hr creatinine clearance levels.
- Ultrasonography is done for renal length, renal cortical thickness and echotexture.
- Cortical thickness was measured in sagittal plane over the medullary pyramid perpendicular to the capsule in the upper and middle thirds of the kidney using a standard gray-scale B-mode US apparatus with a 3.5-5 MHz curvilinear transducer probe on Philips ultrasound machines.
- The bipolar length was measured from the upper to the lower pole, in the sagittal plane.

**5 stages of CKD based on GFR**

**Stage 1:** with normal or high GFR (GFR>90mL/min)

**Stage 2:** Mid CKD /(GFR=45.59mL/min)

**Stage 3A:** Moderate CKD (GFR=45.59mL/min)

**Stage 3B:** Moderate CKD (GFR=30.44mL/min)

**Stage 4:** Sereve CKD (GFR=15.29mL/min)

**Stage 5:** End Stage CKD (GFR<15mL/min)

The GFR is considered the best marker for renal function. The early stages of renal function impairment are clinically silent and are diagnosed only by measuring GFR.



Figure 1

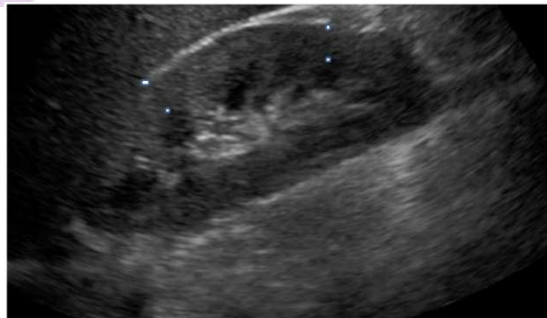


Figure 2

Statistical analysis was performed using SPSS v23.

RCT, renal length, and eGFR values at the beginning and at the end of the study, were compared using the paired-samples t test.

Additionally, Pearson correlation analysis was conducted between renal length and eGFR, RCT and eGFR.

**RESULTS**

**DATA COLLECTED FOR ANALYSIS**

**Table 1:** Mean Values(Mean Age.....55yrs)

	S.Cr.	eGFR	RCT(mm)	RENAL Length (mm)
Beginning	2.7	35.91	5.66	91.18
End	3.6	28.41	5.18	90.13

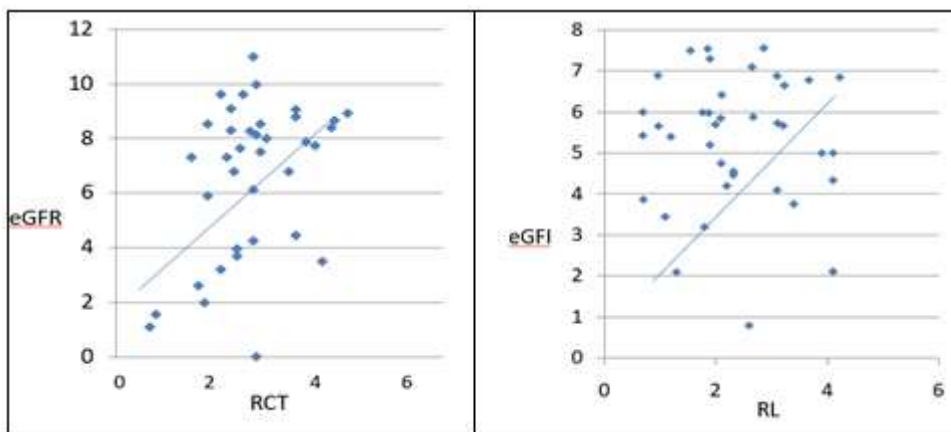


Figure 3

Figure 4

Figure 3: SCATTER CHART showing relation between eGFR and RCT; Figure 4: SCATTER CHART showing relation between RL and eGFR

### DISCUSSION

Ultrasonography is routinely performed in patients with CKD. Therefore there is a lot of interest in relating US findings to kidney function. Studies show that kidney volume shows a good correlation with kidney function but difficult to measure. Renal length is routinely reported and shows a good correlation with eGFR. Recent studies show RCT has a better correlation than renal length. Our study supports the view. RCT findings should also be routinely reported during US.

### CONCLUSION

In the present study we find a statistically significant correlation between:

**Table 2:**

	P value	R
eGFR and RCT	≤0.01	0.89
eGFR and Renal Length	≤0.01	0.68

Present study showed a slightly higher correlation coefficient for RCT and eGFR compared to Renal length and eGFR.

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Source of Support: None Declared  
Conflict of Interest: None Declared