Renal Length, Packed Cell Volume and Biochemical Parametres in Subjects with Chronic Renal Failure: A Preliminary Report

Salako BL[1], Atalab OM[2], Amusat AM[1], and Adeniji-Sofoluwe[2]*

Department of Medicine[1], University College Hospital, Ibadan and Department of Radiology[2], University College Hospital, Ibadan

ABSTRACT

The constellation of laboratory and imaging findings that distinguish progressive chronic kidney disease (CKD) from acute renal failure are bilaterally small kidneys, elevated PTH, creatol, carbamylated haemoglobin levels, anaemia, hyperphosphataemia and hypocalcemia with elevated parathyroid hormone levels, and a urinary sediments that reveal proteinuria and broad casts. There has been a documented significant correlation between renal length and GFR, but, the relationship between renal length and other ureamic and biochemical parameters is still unclear.This study assessed the relationship between renal length and serum biochemistry among chronic renal failure patients seen at the University College Hospital, Ibadan.Patients with chronic renal failure who presented for the first time in predialytic phase were recruited. Renal ultrasound was used to assess renal length and based on this subjects were classified into those with shrunken kidneys and those with normal kidneys. Blood chemistry including PCV, serum urea and creatinine were performed. Creatinine clearance was calculated using Gault and Cockroft equation. The data were processed using the Statistical Package for the Social Sciences (SPSS) by comparing the means of biochemical parameters of the two groups.Twenty-one patients completed the study; there were 14 males and 7 females with age range between 24- 72 years, mean age of 44.2 (15.4 SD) years. Thirteen (61.9%) of them had kidney length in the abnormal range (less than 9cm). No patients had enlarged kidneys. Majority of the patients in this study had bilateral shrunken kidneys but there were no correlations between kidney length and serum creatinine, urea, PCV and creatinine clearance.

INTRODUCTION

There has been a dramatic increase in the incidence of end-stage renal disease as well as a shift in the relative incidence of etiologies of chronic renal disease in the last two decades [1]. The prevalence of chronic renal disease (CRF) in this environment is 6.8% and up to 4-9 new cases are reported every month [2].

The constellation of laboratory and imaging findings that distinguish progressive chronic kidney disease (CKD) from acute renal failure are bilaterally small kidneys, anaemia hyperphosphataemia and hypocalcemia with elevated parathyroid hormone levels, and urinary sediments that reveal proteinuria and broad casts. There has been a documented significant correlation between renal length and GFR; however, literature search of the past years has failed to document a precise relationship between renal length and other biochemical parameters [3].

In practice, unpublished observation has shown that most patients with chronic renal failure often do not present with obviously shrunken kidneys.

The purpose of this study was to assess renal length among chronic renal failure patients seen at the University College Hospital, Ibadan with a view to demonstrating the relationship between kidney length, GFR and some biochemical parameters.

MATERIALS AND METHODOLOGY

It is a prospective cohort study. Patients with chronic renal failure who were available for the study, who presented for the first time and who have not had any form of dialysis before were recruited. Renal ultrasound was used to assess renal length, which was performed by an experienced radiologist, and normal kidney length was taken to be between bipolar lengths of 9-12cm [4,5, 6, 7]. Kidney length below 9cm was

Corresponding author : Dr. B. L. Salako

Department of Medicine, University College Hospital, Ibadan

taken as shrunken and above 12cm was taken as was used to assess kidney size in this study since it has been shown to have the lowest interobserver variation and therefore better reproduceability[5] than renal volume or weight. Blood chemistry including PCV, serum urea and creatinine were performed at the chemical pathology department of the University College Hospital, Ibadan. Creatinine clearance was calculated using Cockcroft and Gault equation. The data was processed using the Statistical Package for the Social Sciences (SPSS Inc, Chicago, Illinois, USA). Subjects were classified into those with shrunken kidneys and those with normal size kidney. The mean of the biochemical parameter values for the two groups were determined and comparison was done between patients with normal and abnormal kidney length using Chi square. Correlation was by Pearson correlation coefficient. The level of significance was set at 0.05. Patients with kidney failure due to diabetes mellitus, obstructive uropathy, obese or pregnant subjects or subjects who have received blood transfusion or dialysis before presenting in UCH were excluded from the study.

RESULTS

Twenty-one patients were recruited for the study; there were 14 males and 7 females with age range between 24- 72 years, mean age of 44.2 (15.4 SD) years. Thirteen of them had kidney length less than 9cm. No patients had enlarged kidneys. Table 1 shows the distribution of normal and abnormal kidney length. Table 2 shows the calculated creatinine clearance, 66.7% of the patients had creatinine clearance of less than 15mls/min. Table 3 shows comparison between PCV and biochemical parameters of patients with normal and abnormal kidney length. There were significant differences in age P=0.0001, serum creatinine P=0.001 and creatinine clearance P= 0.00001. Whereas there were no significant differences in serum urea P=0.179, weight P=0.064 and PCV P=0.94. However, there were no correlations between kidney length and serum creatinine, urea, PCV and creatinine clearance.

Table 1: Distribution of normal and abnormal kidney length

Kidney length	Frequency	Percent (%)
Abnormal	13	61.9
< 9cm	8	38.1
Normal	21	100.0
9-12cm		
Total		

Table 2: Calculated creatinine clearance using Cockcroft and Gault equation

GFR (ml/min)	Frequency	Percent (%)
< 15	14	66.6
15- 29	5	23 .8
30- 59	2	9.6
60-89	0	0
Total	21	100.0

DISCUSSION

Patients with end stage kidney failure often showed bilateral shrunken kidneys, however others at various stages of the disease may exhibit kidney length within normal range. The present study showed that majority of the patients in this study had bilateral shrunken kidneys. Although, there is little evidence available to prove the accuracy of ultrasonography scan in the evaluation of renal size, renal length, which was used to assess kidney size in this study, has been shown to have the lowest interobserver variation and therefore better reproducibility than renal volume or weight.

Renal volume and weight often underestimate renal size and also have large inter and intraobserver variations [3, 5, 8]. A reduction in renal length of less than 9cm considered as evidence of shrunken kidney in our patients has also been used by Rodriquez-de-velasquez *et al* in their study [9]. Contrary to the study by Emamian et al who found correlation between renal length and creatinine clearance in 665 adult volunteers [5], we found no correlation in the kidney length of patients with CRF and creatinine clearance. There was also no correlation between serum creatinine, urea and PCV of the patients although there were significant differences between the means of the ages, serun creatinine and creatinine clearance of patients with normal and shrunken kidneys. In a previous study, among 26 diabetic

Table 3: shows comparison of mean age, biochemical parameters/PCV and kidney length.

Renal Length	N	Mean	Std. Deviation	P-Value
Average Normalcy				
Age (years) Abnormal	13	42.69	17.25	0.00001
Normal	8	46.62	14.00	
PCV(%) Abnormal	13	22.30	4.64	0.9455
Normal	8	22.37	4.80	
Urea(mg/dl) Abnormal	12	175.16	90.45	0.179154
Normal	8	181.12	85.44	
Creatinine(mg/dl) Abnormal	13	13.42	11.37	0.011590
Normal	8	9.66	5.76	
Weight(kg) Abnormal	13	66.51	9.66	0.064059
Normal	8	69.71	19.73	
Creatinine Clearance Abnormal	13	11.05	10.48	0.000001
Ml/min Normal	8	22.5	21.74	

subjects an inverse correlation was documented between mean renal length and serum creatinine while in another study, progressive impairment in red blood cell deformability was associated with renal function loss in all patients regardless of the presence or absence of diabetes[10,11]. We recognize that this is a short report; therefore the lack of correlation in this study may be due to the small numbers of the patients studied. Also the difference between the results of the studies mentioned above and the present one may be due to differences in the study population. Further more, GFR was estimated using the Cockroft-Gault equation, which took into consideration only effects of age, gender and body weight on serum creatinine, estimated GFR is believed to be a more accurate predictor of kidney function because it accounts for these expected differences in muscle mass. However, there are some limitations of this calculated GFR. It may not be accurate if kidney function is fluctuating and not in a steady state or in cases where muscle mass is abnormal. The GFR estimate may also be inaccurate in extremes of age and in patients with severe malnutrition or obesity, paraplegia or quadriplegia, and in pregnant women.

In conclusion, majority of our patients with CRF presents with bilateral shrunken kidneys, but there were no correlations between renal length, creatinine clearance, PCV and serum creatinine. A lager study may however, come up with a more concrete documentation.

REFERENCES

1. CO Alebiosu and OE Ayodele. The global burden of chronic kidney disease and the way forward. Ethn. & Dis. 2005; 15 : 418-423.
2. Kadiri S and Arije A. Temporal variations and meteorological factors in hospital admissions of chronic renal failure in southwest Nigeria. West Afri. J. Med. 1999 18 : 49-51
3. Ememian SA, Nielsen Nielsen MB and Pedersen JF. Kidney dimension at sonography: correlation with age, sex, and habitus in 665 adult volunteers. Am. J. Roentgeno 1993; 160: 83-
4. Sauders RC. Clinical sonography: a practical guide.1984, 2nd edition.
5. Ememian SA, Nielsen MB and Pedersen JF. Intraobserver and interobserver variations in sonographic measurements of kidney size in adult volunteers. A comparison of linear measurements and volumetric estimates. Acta Radiol 1995; 36: 399.

6. Odita JC, and Ugbodaga CI. Roentgenologic estimation of kidney sizes in adult Nigerians. Tropical & Georgraphical Medicine. 1982; 34: 177-18
7. Akinkugbe O.O and Abiose P. Renal sizes and weights in adult Africans. EAST Afr. Med. J. 111970; 47 :224-229.
8. Hricak H and Lieto RP. Sonographic determination of renal volume. Radiology 1983; 148: 311.
9. Rodriquez-de-velasquez A and Yoder IC. Imaging the effects of diabetes on the genito urinary system. Radiographics 1995; 15: 1051.
10. Avram MM, Hurtado H, Renal size and function in diabetic nephropathy. Nephron; 1989; 52 : 259-61
11. Brown CD, Ghali HS, Zhao Z, Thomas LL and Friedman EA. Association of reduced red cell deformability and diabetic nephropathy. Kidney Int. 2005; 67: 295-300