The Sonographic Estimation of Renal Length and Determination of the Main Causes of Chronic Renal Failure

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Abstract: The incidence of chronic renal failure had been increased in recent years. The disease is costive and needs special care which is very expensive. The aims of this study were to identify the main causes and to measure the renal length using ultrasound. The study was conducted at Ali Fadl Hospital and Al Salam Hospital in Khartoum State from the period of January to April 2012. There were 53 patients with confirmed chronic renal failure had been selected to satisfy the study. All patients had been scanned with ultrasound to measure the length of the kidneys. A clinical sheet was designed to include the clinical history of the patients. It was observed that every patient could have more than cause of CRF, So the percentage of the main causes would not complete the full hundred percentage. The study confirmed that diabetes, hypertension and glomerulonephritis were the main causes of chronic renal failure which represented 91.9%, 83.8% and 94.6% respectively. The study showed most of the right renal lengths (right Kidney) was ranged between 4.3 to 5cm which represent approximately 55% of the measurements. The renal length of the left kidney was mainly ranged between 5 to 5.5 cm and represent 64.15 %. The mean value of the length of the right kidney was 5.95 cm and the left was 6.14cm.
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Key words: Estimation, renal length, patients, chronic renal failure, sonography

Introduction:

Chronic renal failure (CRF) is the slow loss of kidney function over period of months or years (K dog, National Kidney Foundation,2002). CRF is much more common than people realized and often goes undetected and undiagnosed until the disease is well advanced and kidney failure is fairly imminent (webmd.com/a-to-z)

Diabetes, hypertension and glomerulonephritis are regarded the most common causes of CRF. Together these cause approximately 75% of all adult causes (United States renal data system). Diabetes cause about 35% of chronic kidney diseases since the blood sugar level remains high, this damage gradually reduces the function of the kidneys. High blood pressure (hypertension) causes another 30 % of all kidney diseases. Because hypertension often raised with CRF, high blood pressure may further damage kidney function even when another medical condition initially caused the disease (en-wikipedia.org).

Previous studies have shown that renal volume calculated at ultrasound is more exact measurement of a functioning than renal length (Emamianetal, AJR 1993) and (Jones et al ultrasound Med, 1983). In patients with chronic renal failure,the renal cortical echogenicity increases at ultrasound(KhatiNJ,Hill MC, Kimmel PL, the essential ultrasound 2005). In addition, the renal cortex often becomes thinned (Morghazi S, Jones E. et al. Kidney int, 2005). Often this finding occurs with a normal bipolar renal length and an increase in the relative amount of central sinus fat (Levey AS et al, Ann Intem Med, 2006).

Ultrasound (US) imaging of the kidneys has greatly has greatly improving with introduction of wideband transducer and advances in Doppler technology. US is the first line imaging investigation to be employed in patients with renal failure, hematuria or proteinuria, after clinical and laboratory evaluation. Many renal disorders are associated with changes in kidney size, therefore, in patients with chronic problems, such as recurrent urinary tract infection, vsico-ureteric reflux, or a neurogenic bladder, renal growth is monitored (Rosenbaum DM, Korngold E, Teele RL,*AJR* 1984).

Renal length is the most commonly used quantitative measure of renal size for comparison with established standards (KlareB,*PediatrRadiol* 1980). Renal volume measurement is used less frequently because it requires calculation based on multiple measurements, and observer error may approach 25% (Sargent MA, Gupta SC.*AJR* 1993 and Han BK, Babcock DS, *AJR* 1985).Relatively recently, 3D ultrasound has been studied for use in the measurement of renal parenchymal volume (Riccabona M, Fritz G, Ring E.*AJR* 1993). Deviation in renal size from established normal renal values indicates alteration in normal renal growth and is an important criterion in the diagnosis of renal diseases.

Materials and Methods:

This is a retrospective and descriptive study, the study population was patients with chronic renal failure (CRF). The study was conducted at Ali Fadl Hospital and Al salam Hospital in Khartoum State from the period of January to April 2012.

There was 53 patients with chronic renal failure had been selected randomly to satisfy the study. The data had been collected from the real images of ultrasound and the other part of data was collected from the data clinical sheet. The patients had been scanned with ultrasound machine using the international protocol of abdomen ultrasonography. A longitudinal scanning was performed with 3.5 MHz probe and 5 MHz for scanning thinner patients. Once the kidneys were located, the transducer was rotated at varying degrees to visualize the long axis of the kidney. Then the length was measured from the upper pole to the lower pole with the patient in supine position and sometimes in lateral decubitus.

A clinical data sheet was designed to include the clinical history of the patients. Other data was collected from patients files as well as the designed questionnaire. It was noted that the causes of the CRF were complicated, beside history of diabetes, we observed glomerunephritis and hypertension always developed and correlated. So, majority of patients have had diabetes and hypertension together. Other patients developed glomerulonephritis, so the percentage of clinical history of the main causes would not be equally similar and did not complete hundred percentage. Finally, every patient had more than one cause of chronic renal failure.

The data had been analyzed using SPSS programme and presented in tables and figures, statistical tests were used such as Chi square test. For ethical consideration, a permission was taken from every patient and they had been taught that all names would not be mentioned and they were agree with that.

Results

Table (1) shows clinical presentation of patients with renal failure

Clinical features	frequency	Percentage%
Edema	53	100
Loss of weight	53	100

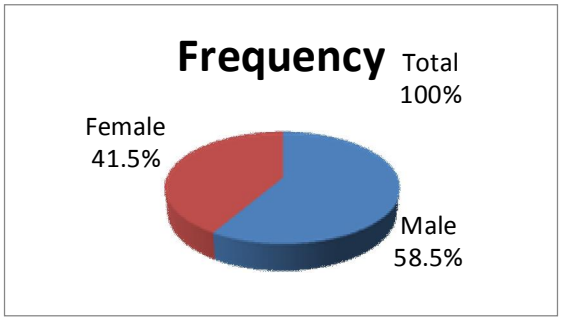

Figure (1) shows the gender distribution of patients with chronic renal failure

Table (2) shows the age groups of patients with chronic renal failure

Age group	Frequency	Percentage
20-29	3	8.1
30-39	9	24.3
40-49	3	8.1
50-59	10	27.0
>60	12	32.4
total	53	100

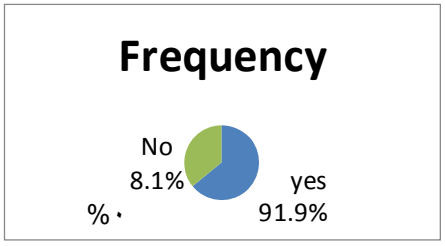

Figure (2) Shows patients with chronic renal failure with history of diabetes

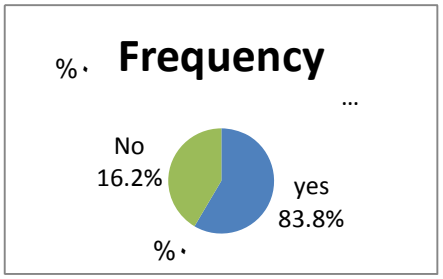

Figure (3) Shows patients of chronic renal failure with history of Hypertension

Table (3) Shows patients of chronic renal failure with history of diabetes

	Frequency	Percentage%
Valid yes	35	94.6
No	18	5.4
Total	53	100

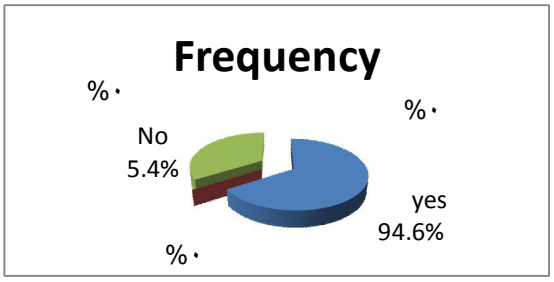

Figure (4) Shows patients of chronic renal failure with history of glomerulonephritis

Table (4) shows estimation of length(cm) of right kidney of patients with chronic renal failure

Length of right Kidney	frequency	Percentage%
4.3-5 cm	29	54.71
5.1- 6.5 cm	18	33.96
7-7.3 cm	6	11.32
Total	53	

Mean value renal length is 5.95 cm

Table (5) shows estimation of length(cm) of the left kidney of patients with chronic renal failure

Length of left Kidney	**frequency**	**Percentage %**
5-5.5 cm	**34**	**64.15**
6- 6.5 cm	**17**	**32.07**
7-7.5 cm	**2**	**3.77**
Total	**53**	

Mean value of renal length is 6.14 cm

Table (6) Shows the relation between CRF and hypertension

	chronic renal failure		
	Yes	**No**	**Total**
Hypertension: Yes Percentage%	**31** **79.5%**	**1** **2.6%**	**32** **82.1%**
No Percentage%	**6** **15.4%**	**1** **2.6%**	**7** **17.9 %**
Total count % of total	**37** **94.9%**	**2** **5.1%**	**39** **100%**

Table (7) shows Chi-Squire tests(CRF and hypertension)

	Value	**df**	**Asymp.Sinificance (2 tailed)**
Pearson Chi-Squire	**1.47**	**1**	**0.0225**

Interpretation:

According to the table above, researchers found that the value of the test is (2χ) equals (1.47) of the potential value which is 0.025, this means there is significant difference and correlation exists between hypertension and chronic renal failure.

Table (8) Shows the relation between CRF and diabetes

	chronic renal failure		
Diabetes	**Yes**	**No**	**Total**
Yes Percentage%	**34** **87.2%**	**1** **2.6%**	**35** **89.7%**
No Percentage%	**3** **7.7%**	**1** **2.6%**	**4** **10.3 %**
Total count % of total	**37** **94.9%**	**2** **5.1%**	**39** **100%**

Table (9) shows Hypothesis Test With Chi-Squire tests (CRF and Diabetes)

	Value	**df**	**Asymp.Significance (2 tailed)**
Pearson Chi-Squire	**1.47**	**1**	**0.0225**

Interpretation:

According to the table above, researchers noticed that, value of the test (2χ) equals 3.618, but the potential value is approximately 0.02 which is less than 0.05.So, there is significant correlation between chronic renal failure and diabetes (table).

Table (10) Shows patients of chronic renal failure with history of glomerulonephritis

	Frequency	Percentage%
Valid yes	35	94.6
No	18	5.4
Total	53	100

Discussion

The main clinical features of chronic renal failure (CRF) are usually edema and loss of weight which were presented at 100% of all the patients. The study population was male (59.5%) and female (40.5%) who were suffering from CRF.

In the study, it was noted that the age of 50 years old was the most affected and represent 59.4%. The study showed that 92% of the patient had a history of diabetes. It is regarded the most common cause of CRF, for approximately 40% of patient on renal replacement therapy (epocrates.com, CRF-basic etiology). It was observed that every patient with diabetes develops hypertension which were closely related together. In this study, there was significant correlation between diabetes and CRF, Pearson Chi squire test value was 0.02 which means there was significant correlation between CRF and diabetes.

The study showed that there as 83.8 % of the patients with CRF had a history of hypertension. It was observed that hypertension is closely related related to renal damage. Other study showed that hypertension develops in 95% of patients with CRF before end stage renal disease does. If untreated, this type of hypertension is more likely to enter the malignant phase than is essential hypertension (madden.luc.edu). Hypertension is the second most common cause accounting for one third of patients on renal replacement therapy. Often people are given the diagnosis of hypertensive renal disease if no other identifiable etiology is evident. The study showed that there was a strong significant correlation between CRF and hypertension, p-value was 0.02, this means there was significant difference and correlation exists between hypertension and CRF as shown in table (9)

The study showed that 94.6 of the patients with CRF had a history of glomerulonephritis. It is considered the third cause of CRF. Nearly all forms of acute glomerulonephritis have a tendency to progress to chronic glomerulonephritis. The condition is characterized by irreversible and progressive glomerular filtration rate (GFR) and retention of uremic toxins. The diagnosis of CKD can be made without knowledge of specific cause (Kawasaki Y, 2011)

Renal length correlates with renal function in chronic kidney disease, and therefore, bipolar renal lengths are almost always reported at renal ultrasound. The renal length has been estimated in this study since it is a significant factor to measure the degree of renal damage. In literature renal were 12.4cm with St. deviation=9cm for men and 11.6cm for women.(Benjamin C, Raja M, Mario F, 2006) Our study showed half of these normal value of renal lengths had been lost. In this study, the estimation of the length right kidney was 5.95 cm(the mean value) which is less than 6cm and decrease from the normal size with approximately 50%. On the other hand, the mean value of left renal length(left kidney) was 6.14cm as measured with ultrasound.

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