ULTRASONOGRAPHIC MEASUREMENT OF RENAL CORTICAL THICKNESS AND RENAL LENGTH IN ADULTS WITH NORMAL RENAL FUNCTION

Priyanka Racha1, Sushmitha2 , VikasChennamaneni3 ,
1 Post graduate student, 2Associate professor,3Professor,Prathima Institute of Medical Sciences, Karimnagar, Telangana, India.
Email: pinky.amith@gmail.com

Background/Objective: Renal cortical thickness and renal length are important indices for many renal diseases. Ultrasonography has been introduced as an effective method to determine different renal measurements. The objective of this study is to determine the sonographic measurement of renal cortical thickness (RCT) and renal length in adults with normal renal function in karimnagar population.

Patients and Methods: 148 healthy subjects aged 18-70 years with no history of renal diseases were studied prospectively. These patients had normal Creatinine values. They also had a normal kidney sonography. Gray scale sonography was used to measure the distance between the outer border of the medulla and the renal capsule, presenting as Renal cortical thickness and bipolar length was measured from upper pole to lower pole in sagittal plane.

Results: 52 men and 96 women with a mean±SD age of 38.6±15.27 years underwent sonography. The mean±S Drenal cortical thickness of our population was 9.16±2.04 mm.The mean±SDrenal cortical thickness was 9.81±1.95 mm for right kidney, 10.15±2.13mm for left kidney. The mean±SD length of our population was 94.93±9.02 mm.The mean±SD renal length was 94.56±8.67mm for right kidney ,100.04±9.37mm for left kidney .

Conclusions: Renal cortical thickness and length varies with many variables including gender, height and decreases in chronic kidney diseases. The results of this study can be used for evaluation of renal cortical thickness and renal lengthto determine abnormal clinical conditions.

INTRODUCTION

Ultrasonography is one of the several methods used to evaluate renal morphology. Different studies show that ultrasonography is a rapid and non-invasive diagnostic method for renal diseases and also the first method of choice for screening and follow-up of patients and healthy people1.Moreover, ultrasonography has been shown as a proper way for studying acute rejection of the transplanted kidneys, renal collagen-vascular diseases, and diagnosis of renal cystic lesions2,4.As the change in renal cortical thickness (RCT) is an important sign of renal disease, ultrasonographic measurement of renal cortical thickness has been suggested as an index for studying the health status of the kidney. Measurement of renal cortical thickness is used for differentiation between acute and chronic renal failure5.Although different measures

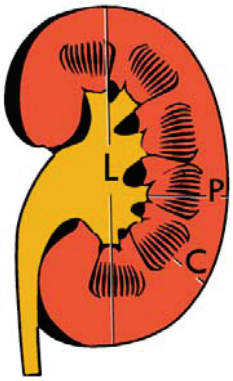
have been reported for normal renal cortical thickness in various references, measurement of renal cortical thickness, just like other body sizes, depends on race and body mass. Ablett et al, showed that in normal adult kidneys, sonographic bipolar renal length measurements are reasonably reliable andpractical6.There has been no study to determine the measurement of renal cortical thicknessand renal length based on the demographic characteristics of our population.Therefore, the objective of this study is to measure the sonographic values of normal renal cortical thickness and renal length in karimnagar population.

Patients and Methods

This cross-sectional study was conducted from september 2018 to July 2019. 159 patients 18 to 70 year old from Prathima institute of medical sciences were enrolled in this study. Institutional ethical committee approval was granted, and an informed written consent was signed by eachpatient.

A personal information form including age and gender of the participant was completed.

All participants history of previous or present renal diseases was taken.



Exclusion criteria: patients with frequent urinary tract infections (UTI), obstructivenephropathy,polycystickidney,abnormal urinary or biochemistry laboratory tests in their history malignancy and tumors are excluded from the study.

Inclusion criteria

Age 18 to 70 years satisfying exclusion criteria

Ultrasonography of all participants was carried out.

All ultrasonographies were performed by the same radiologist. Gray scale sonography was preformed for all subjects, using a 3.5-5 MHz multi-frequency curvilinear probe (Philips ultrasound machine). Participants were examined in supine oblique positions, left and right for each kidney and the distance between the renal capsule and the external margin of the hypoechoic medulla was measured for each kidney (Fig. 1).Bipolar length was measured from the upper pole to the lower pole in the sagittal plane.

Data were analyzed by Microsoft Excel 2007 version.

Data were presented as mean and mean±SD.

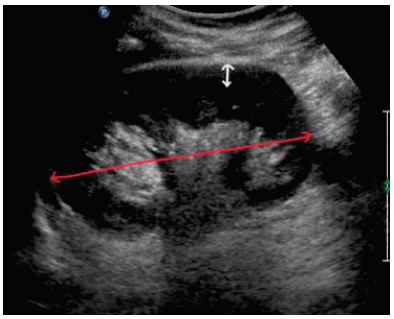


Fig.1. The sonographic view of the measurement of renal cortical thickness(white arrow) and renal length(red arrow)

Results

Of the 159 volunteers, 11 were excluded from the study because of the renal abnormalities found in the history, physical examination or sonography. 3 participants had a history of Urinary tract infections, 6 had a history of calculi, two had pyuria.
Of 148 studied participants, 52 (35.13%) were male and 96 (64.86%) were female.
The mean±SD age of participants was 38.6±15.27 (range: 20–70) years.
In our study, the renal cortical thickness mean±S Dof kidneys was 9.16 mm±2.04.
The mean±S Drenal cortical thickness was 9.81 mm±1.95 for the right kidney and 10.15 mm±2.13 for the left kidney .
The mean renal cortical thickness was 9.79 mm in men and 8.9 mm in women
In men, the mean renal cortical thickness of the right and left kidneys was 9.79mm and 9.8mm respectively.
In women, the mean renal cortical thickness of the right and left kidneys were 9.83mm and 10.34 mm, respectively .
In our study, the mean±SD length of kidneys was 94.93 mm±9.02.
The mean±SD length was 94.56±8.67mm and100.04±9.37mmfor the right and left kidneys, respectively.
In men, the mean Renal length of the right and left kidneys was 92.22mm and 97.56mm respectively.
In women, the mean Renal length of the right and left kidneys was 95.88mm and 101.44mm respectively.

Discussion

Ultrasonography is a common examination which has been performed for assessment of renal anatomy3. Ultrasound is useful for diagnostic and prognostic purposes in chronic kidney diseases .When disease progresses there is decreased renal size and cortical thinning7.
The kidney is divided into parenchyma and renal sinus. The renal sinus is hyperechoic and is composed of calyces, the renal pelvis, fat and the major intrarenal vessels. In the normal kidney, the urinary collecting system in the renal sinus is not visible, but it creates a heteroechoic appearance with the interposed fat and vessels. The parenchyma is more hypoechoic and homogenous and is divided into the outermost cortex and the innermost and slightly less echogenic medullary pyramids10.

The length of the adult kidney is normally 10–12 cm, and the right kidney is often slightly longer than the left kidney10,11.

The adult kidney size is variable due to the correlation with body height and age10,11,13,14. Cortical thickness should be estimated from the base of the pyramid and is generally 7–10 mm. If the pyramids are difficult to differentiate, the parenchymal thickness can be measured instead and should be 15–20 mm.

Although renal volume is the most accurate measure of renal size, kidney length is the most clinically useful measurement of kidney size because it is simple to obtain and minimally affected by interobserver variability. kidney length is especially important in distinguishing Acute Kidney Injury from Chronic Kidney Disease.

Most of the previous studies have measured the length of the kidney and its relation with other factors. Few studies have evaluated the renal cortical thickness and its relation with some other factors such as age, gender, weight, and height. We know that renal cortical thickness depends on ethnicity and some environmental factors. To establish some preliminary data on our population, we determined the Renal cortical thicknessand renal length in subjects without known renal diseases .

In the two other studies using arteriography, the normal renal cortical thickness has been reported as 5–12 mm in one8and 5–8 mm in another9.The above results are in approximate agreement with our findings (mean±SDrenal cortical thickness of 9.16 mm±2.04). The variation in cortical thickness is a reflection of the wide range of renal size and configuration of the collecting system. In kidneys with short and stocky infundibuli, the cortex appears thicker than in kidneys with elongated, spideryinfundibuli8.Some references report that the renal length decreases by aging5and that we expect renal cortical thickness also to decrease by age.

Finally, it seems that more population-based studies with a larger sample size are necessary to establish the normal values of the karimnagar population to set the local referencevalues.

Renal cortical thicknessand renal length are mostly useful in differentiating chronic and acute renal insufficiency, because in most chronic kidney disease, renal cortical thinning would be present; on the other hand, in acute states of renal failure, we do not expect a decrease in Renal cortical thickness and renal length.

References

1. Lawson TL, McClennan BL, Shirkhoda A. Adult polycystic kidney disease: ultrasonographic and computed tomographic appearance. J Clin Ultrasound 1978;6(5):297-302.
2. Frick MP, Feinberg SB, Sibley R, Idstrom ME. Ultrasound in acute renal transplant rejection. Radiology1981;138(3):657-60.
3. Wilson D.A. Ultrasonic scanning of the kidneys. Ann. Clin. Lab. Sci. 1981;11:367–376. [PubMed]
4. Chuang YF, Tsai TC. Sonographic findings in familial juvenile nephronophthisismedullary cystic disease complex. J Clin Ultrasound 1998;26(4):203-6.
5. Edell SL, Kurtz AB. Normal renal ultrasound measurements. In: Goldberg BB, Kurtz AB, editors. Atlas of ultrasound measurements. Chicago, Year Book, 1990. p.146.
6. Ablett MJ, Coulthard A, Lee RE, Richardson DL, Bellas T, Owen JP et al. How reliable are ultrasound measurements of renal length in adults? Br J Radiol1995;68(814):1087-9.
7. Emamian S.A., Nielsen M.B., Pedersen J.F. Tenth percentiles of kidney length in adult volunteers. Am. J. Roentgenol. 1994;163:748. doi: 10.2214/ajr.163.3.7980828.
8. Khademi M. Angiographic measurement of renal compartments. Corticomedullary ratio in normal, diseased states and sickle cell ane- mia. Radiology 1974Oct;113(1):51-8.
9. Abrams HL. Quantitative derivates of renal radiologic studies. An overview. Invest Radiol1972;7(4):240-79.

10. O'Neill W.C. Renal relevant radiology: Use of ultrasound in kidney disease and nephrology procedures. Clin. J. Am. Soc. Nephrol. 2014;9:373–381. doi: 10.2215/CJN.03170313.

11. Sidhu P.S., Wui K.C. Measurement in Ultrasound. Oxford University Press Inc.; New York, NY, USA: 2004. :
12. Rumack C.M., Wilson S.R., Charboneau J.W. Diagnostic Ultrasound. 3rd ed. Elsevier Health Sciences; St. Louis, MO, USA: 2005.
13. Emamian SA, Nielsen MB, Pedersen JF Intraobserver and interobserver variations in sonographic measurements of kidney size in adult volunteers. A comparison of linear measurements and volumetric estimates. ActaRadiol 36: 399–401, 1995
14. Emamian SA, Nielsen MB,Pedersen JF,Ytte L Kidney dimensions at sonography: Correlation with age, sex, and habitus in 665 adult volunteers. AJR Am J Roentgenol 160: 83–86, 1993
15. Miletić D, Sustić A, Mozetic V, Stimac D, Zauhar GSonographic measurement of absolute and relative renal length in adults. J Clin Ultrasound 26: 185–189, 1998

How to cite the article: Racha P, sushmitha,Chennamaneni V,Ramesh Ultrasonographic measurement of renal cortical thickness and renal length in adults with normal renal function. Perspectives in Medical Research 2019; 7(3): 57-61
Sources of Support: Nil, **Conflict of interest:** None declared