

Original Article

Sonographic Assessment of Renal Length of Adults in Lagos, Nigeria

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ABSTRACT

Introduction: Ultrasound is an important imaging modality used in the prognosis and diagnosis of renal conditions and diseases and also in the evaluation of kidney donors. This study aimed at providing a reference for the normal metric variables of the kidney such kidney lengths of healthy Nigerian adults in Lagos State and to compare with previously obtained results.

Materials and Methods: This study was conducted in the radiology department of Ikorodu Hospital, Lagos State within a 6 months period. This study adopted a descriptive cross-sectional study design with a cluster sampling approach which consisted of 150 adults (with 300 kidneys) participants ages 18-87 years. Real-time gray-scale ultrasonic scanning using Prosound 3500 Aloka device and a 3.5–5 MHz curvilinear explorer was employed for the abdominal imaging. The data acquired were compiled and explored via the Statistical Package for the Social Sciences (SPSS) version 20. The student's t-test was utilized in probing for statistical significance between age as well as gender in relation to renal length. P-value < 0.05 was adjudged to be significant.

Results: The kidney length was of a greater distance in males, and the length of the left kidney was more extensive than that of the right kidney in both sexes. Average kidney length was greater on the left when compared to the right among the various age groups. No significant association was noted between kidney length and age as well as gender.

Conclusions: Normal values for kidney length and diversifications in the kidney length of healthy adults in Nigeria have been established.

Keywords: Kidney; Renal length; Ultrasound

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INTRODUCTION

Ultrasound is an imaging modality that has shown its usefulness as an essential tool in the evaluation of renal dimensions, prognosis as well as diagnosis of renal diseases and conditions. It is also employed in performing renal biopsy in adults and children.¹ It is a simple, quicker, convenient, non-invasive procedure which has replaced largely the conventional radiography in the visualization and estimation of renal dimensions.² Ultrasound has shown to be advantageous over other imaging techniques simply because it requires neither sedation nor ionizing radiation.² Over the years renal length has been an essential parameter in assessment of kidney size which could be used as a diagnostic tool in cases of disease conditions such as hypertension, hepatitis, renal cystic diseases, kidney stones, renal arterial stenosis, recurrent urinary tract infections, vesicoureteral reflux, chronic kidney disease,

kidney tumors etc.³

The kidney is a paired retroperitoneal organ that is placed symmetrically in the abdominal region, this organ consists of various parameters as renal length, renal volume, cortical volume or thickness which can be obtained with the aid of an ultrasound used in the evaluation of its size.⁴ The renal length which is obtained by the measurement of the longitudinal plane parallel to the longest renal axis, due to its low inter-observer variation and better reproducibility, the renal length has proved to be the best clinical parameter in the estimation of renal size.⁵

Sonographic renal measurement is valid and the bipolar distance of the two kidneys is lengthier in prone than in supine arrangement.²

The ascertainment of the renal dimension employing the ellipsoid technique which is hinged on the multiplication of the length, width, thickness of the kidney (in cm) by 0.5 is precise and is linked to both renal mass volume and surface area.⁶ Renal length and size obtained using ultrasound and manual planimetry confirmed that sonographic renal measurement had preferable concurrence with urographic renal lengths ($r = 0.089$).⁷ A correlation established between ultrasonographic and pyelographic renal lengths showed that pyelographic kidney length is equal to ultrasonographic length times 1.33.⁸

Studies have been conducted to ascertain the renal size using its length such studies were conducted by the likes of Brandt et al in the year 1982 where 52 participants with normal renal functioning were observed which showed that the renal length was directly proportional to the renal size which established the relationship between renal length and size.² Multiple studies were also conducted by researchers on ethnic groups in order to assess the average normal sonographic renal length among various ethnic groups in a population.⁹ Anatomical variants and deviants in individuals can only be identified if a set of standard sonographic measurements have been made as a baseline for future comparison, hence the importance of this study.¹⁰ Publications reveal renal dimensions in normal adults determined sonologically in different parts of the world.^{4,11,12} However, it has been observed from prior knowledge there has been the paucity of literary works on the sonographic assessment of kidneys among Nigerians residing in Lagos state, hence the need for this study to be conducted.

MATERIALS AND METHODS

The ethical endorsement was procured from the Research and Ethics Committee of the Department of Human Anatomy and Cell Biology, Faculty of Basic Medical Sciences, Delta State University, Abraka in Nigeria. This survey is a descriptive cross-sectional survey that was done over a 6 months period, March to August in 2018. This survey was performed in the radiology department of Ikorodu Hospital and Clinic, Lagos State in Nigeria by a radiologist. The sample was obtained using the cluster sampling approach which involved 150 adults (with 300 kidneys) who were recruited from patients conducting a regular health checkup at the hospital. Interviews were conducted for the purpose of the consistent data in the course of the study, questionnaires were recorded which contain information on medical history, age, sex of the participants. In course of this study, certain criteria were expected to be met by the participants before been used such criteria include: Participants must be Nigerians by birth, participants must be within the ages of 18-87 years and participants must have no history of renal disorders. Real-time gray-scale ultrasonic scanning using Prosound 3500 Aloka (ALOKA Inc. Japan, 2004) device and a 3.5–5 MHz curvilinear explorer was employed for the abdominal imaging. Real-time gray-scale imaging was done plying conventional ultrasonographic procedures.⁸ The kidneys were subsequently measured in a perpendicular plane to obtain their length in supine

as well as prone positions. The most prolonged distance from the upper to the lower renal poles (the length) was quantified by the interviewer thrice with the average measurements obtained and analyzed. The data acquired were compiled and explored plying the Statistical Package for the Social Sciences (SPSS), version 20. The student's t-test was utilized in probing for significant age as well as gender variability in renal length. P-value below 0.05 was adjudged to be significant.

RESULTS

A total of 150 adults were enrolled in the study, of which 47% (n=71) were male and 53% (n=79) were female. Age-wise, the most common age group in the study population were of 28-37 year (n=71; 47.33%) followed by 38-47 (n=70; 46.66%). (Table 1).

Table 1: Studied population showing distribution pattern of age

Age (Years)	Frequency	Age (Years)	Frequency
18-27	60 (40.00%)	58-67	29 (19.33%)
28-37	71 (47.33%)	68-77	14 (9.33%)
38-47	70 (46.66%)	78-87	5 (3.33%)
48-57	51 (34.00%)	Total	150 (100%)

Table 2 revealed that the average kidney length was more on the left side of the body. The average length of the kidney as revealed in this study is 95.32 mm. it also revealed that the p-value was > 0.05, thus the consociation between kidney length and age is not a significant one.

Table 3 divulged that the length of the kidney evinced consistent increments with advancing years up to 57 years and thereafter lessening of renal length occurred in both male and female subjects. Afterward, renal length increased once more with increasing age. Since $p > 0.05$ thus the gender difference in kidney length is not significant.

Table 2: T-test table on the consociation between kidney length and age

Age	Right kidney length (average mm)	Left kidney length (average mm)	T-test calculated value	T-test critical value	P-value
18-27	87.53	90.90			
28-37	92.16	95.39			
38-47	93.21	97.02			
48-57	94.54	98.01	2.20	1.96	> 0.05
58-67	93.66	97.18			
68-77	93.91	97.97			
78-87	99.98	102.94			

Table 3: T-test table on the consociation between kidney length and sex

Age (yrs)	Male		Female		T-test calculated value	T-test critical value	P-value
	Right kidney length (average mm)	Left kidney length (average mm)	Right kidney length (average mm)	Left kidney length (average mm)			
18-27	89.56	93.48	86.45	89.5			
28-37	92.54	96.31	91.91	94.79			
38-47	95.2	99.2	91.43	95.09			
48-57	95.32	98.68	93.33	96.97	3.34	1.96	>0.05
58-67	94.34	98.11	92.94	96.19			
68-77	99.22	102.96	84.36	89.00			
78-87	100.6	103.78	97.40	99.60			

DISCUSSION

The disparity of various renal parameters is dependent on different factors of which body mass index, gender, race, as well as age, have an effect on renal parameters such as renal length, renal volume.¹³ Changes in renal parameters often indicated an emerging or already developed disease which requires interpretation with the aid of already existing data on the population regarding renal parameters.¹³ Hence the development of benchmarks parameters for such population.

Earlier studies have lacked consistency on the view in regards to the kidneys length on which is longer or are the same, a certain number of studies have shown that there is a significant difference in their lengths which is concordance with this study.¹⁴ Findings from this study showed similarity with results of studies conducted,^{9,15-17} which depicted the fact that the left kidney was longer than the right. However, this was in dispute with the results obtained from some studies.^{18,19} This inquiry disclosed that the kidneys continue to grow in size until 57 years of age when there is a slight decline in growth. This annotation was similar to the elucidation from studies conducted in Mexico¹¹ and Nigeria²⁰ where a fall in renal length after 60 years was noted. However, this scrutinization differs with another study, who noted that the kidneys attain their matured sizes at early adulthood (age 20 to 29 years).²¹

In course of this study, it was observed that there was no significant association between kidney length and age which

showed agreement with a research conducted by Loftus et al.²² which depicted similar results but these findings were in disagreement with results obtained from a study conducted by Otiv et al.²³ which showed significant association between age and renal length when conducted on both Indian and American children. This study demonstrated that the renal lengths in males were slightly greater compared to the females and that the left kidney length was greater than that of the right kidneys in both genders. This finding concurred with the outcome of another similar study done in Nigeria.²⁰ The reason is attributable to the longer growth spurt in males and also adequate room for the growth of the kidney on the left ascribable to its anatomical site.²⁴ Furthermore, the presence of the liver on the right side hinders the cadenced growth of the kidney on the right in comparison to the left side of the body. Other studies also have delineated distinctness in renal length between males and females.^{13,20} The limitations to this study could be attributed to the fact that a small sample size from only a part in Lagos was used which probably are not the entire representative of the entire Lagos populace.

CONCLUSIONS

It was observed from this study that the left kidney was longer than the right kidney in the entire populace, as well as a fact that there was no significant association between age and renal length. Findings as showed similarity to already published data which would provide reliable and practical baseline data for future reference purpose

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