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## Normal sonographic renal length in adult Southeast Nigerians

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### Summary

The renal lengths of 200 adults with normal renal and cardiac status were measured sonographically in the supine position to establish normative values of renal length for the locality and to correlate them with some anthropometric parameters. The ranges of normal kidney length obtained were 8.3–12.8cm and 8.0–12.5cm for the left and right kidneys respectively. The mean renal lengths of males were slightly higher than those of females. Renal length correlated positively with subject weight and not with the height or age of patients. This study was able to establish a normogram of renal length for the locality, with mean renal length of 10.6cm and 10.3cm for the left and right kidneys respectively. The renal lengths obtained showed no racial dependence. The positive correlation with body weight seems to substantiate the longer lengths of male kidneys versus female kidneys. The study also established a confidence interval of difference between right and left kidneys for the different age groups that could prove invaluable in making critical decisions on size differences in unilateral renal disease.

**Keywords:** *Sonography, renal, length, normative value*

### Résumé

La longueur du rein chez deux cent adultes avec le status rénal et cardiaque normales étaient mesurés sonographiquement en position couchée avait pour but d'établir les valeurs normales dans la localité et faire une corrélation avec d'autres paramètres anthropométriques. Le longueur variait entre 8.3-12.8 cm avec une longueur moyenne de 10.6 cm et 8.0-12.5 cm avec une longueur moyenne de 10.3 cm pour les reins gauche et droite respectivement. La moyenne de longueur rénale des males était légèrement plus élevée chez les males que les femelles et corrélait positivement avec le poids des sujets et pas avec la taille ou l'âge du patient. Un normogramme a été établi sur la longueur normale du rein des adultes de cette localité. La longueur du rein n'avait pas de dépendance raciale. La corrélation positive entre le poids corporel semble substantier la plus grande longueur chez les reins

males que femelles. Cette étude établie aussi la confiance d'intervalle entre les reins gauche et droite pour les différents groupes d'âge, qui pourrait être important dans la prise de décision dans la maladie rénale unilatérale.

### Introduction

The kidney size varies in many disease conditions. Consequently, its evaluation has been a way of assessing the degree of its involvement in disease processes [1,2,3]

In the past, renal size was assessed using conventional radiographic methods. Geometric magnification from the divergent nature of the X-ray beam affected ease of computation [4]. Sonography of the kidneys has mostly replaced conventional urography as gold standard for evaluation of the kidney in renal disorders and combines improved accuracy with the advantage of being non-ionising.

A scrutiny of the literature suggests a paucity of established sonographic renal sizes in this locality. A previous study [5] was carried out in this population group, using the conventional radiographic method.

This work therefore was designed to establish normative values of renal length and to correlate them with some anthropometric parameters. Provision of such a population specific normogram would improve accuracy in predicting normal and abnormal kidney sizes.

### Materials and methods

Two hundred subjects whose aged between 16 and 75 years were randomly selected from 300 ultrasound referrals for abdominal scan at the Radiology Department of the University of Nigeria Teaching Hospital, Enugu. The selection criteria excluded those with identifiable renal or cardiac diseases before and during the scan. The sonographic scans were done using Siemens Sonoline SL-2 Medical Ultrasound unit with a sector probe of frequency 3.5MHz. The unit had electronic calipers calibrated with an assumed ultrasound velocity of 1540 ms<sup>-1</sup>. The scans were done with the subjects in the supine position and an anterior approach with 15° elevation of the side being examined was adopted.

For each kidney, the longest bipolar diameter was obtained. The body height and weight of each subject in the study were measured. The calculated mean values were correlated with age, sex, height and weight using the least square method. Comparisons were made between the values of the right kidney and the left kidneys.



## Results

Table 1 shows the age and sex distribution of the subjects of whom 37.5% (n = 75) were between 26 – 35 years. The range of normal renal length obtained from the study was 8.3 – 12.8cm and 8.0cm – 12.5 for the left and right kidneys respectively, as shown in Table 2. The difference in the confidence interval between the left and the right kidney length were calculated at 95% confidence limit. For example, for the 16-25 years age range the confidence interval was  $0.4 \pm 0.58$  between the left and the right.

**Table 1:** Age and sex distribution of subject

Age (years)	No. of Subjects		
	Male	Female	Total
16 - 25	8 (4%)	12 (6%)	20 (10%)
26 - 35	18 (9%)	57 (28.5%)	75 (37.5%)
36 - 45	18 (9%)	30 (15%)	48 (24%)
46 - 55	22 (11%)	10 (5%)	32 (16%)
56 - 65	11 (5.5%)	4 (2%)	15 (7.5%)
66 - 75	8 (4%)	2 (1%)	10 (5%)
Total	85 (42.5%)	115 (57.5%)	200 (100%)

**Table 2:** Range of length and the confidence interval between left and right sides

Sex Age (yrs)	L (cm)	Males		Confid Int	L	Females		Confid Int
		R (cm)				R		
16 - 25	9.6 – 12.0	9.1 – 11.7		$0.4 \pm 0.58$	9.2 – 12.0	9.3 – 11.7		$0.1 \pm 0.52$
26 - 35	9.6 – 12.2	9.4 – 11.6		$0.4 \pm 0.40$	9.2 – 12.8	9.2 – 12.4		$0.2 \pm 0.31$
36 - 45	9.8 – 12.2	9.7 – 12.1		$0.4 \pm 0.40$	8.9 – 12.6	8.8 – 12.0		$0.3 \pm 0.43$
46 - 55	9.2 – 12.8	8.7 – 12.3		$0.5 \pm 0.54$	9.5 – 11.9	9.2 – 11.8		$0.2 \pm 0.53$
56 - 65	8.5 – 12.1	8.1 – 11.9		$0.3 \pm 0.77$	8.3 – 10.7	8.0 – 12.5		$0. \pm 0.94$
66 - 75	9.3 – 11.9	8.8 – 12.0		$0.2 \pm 0.71$	9.0 – 9.5	8.7 – 9.5		$0.8 \pm 0.68$

**Table 3:** Mean and standard deviation of renal length by age and sex

Age	Male		Female	
	Left	Right	Left	Right
16 - 25	10.8 (0.63)	10.4 (0.68)	10.6 (0.70)	10.5 (0.60)
26 - 35	10.9 (0.63)	10.5 (0.54)	10.4 (0.90)	10.4 (0.80)
36 - 45	11.0 (0.62)	10.9 (0.60)	10.7 (0.97)	10.4 (0.81)
46 - 55	11.0 (0.91)	10.5 (0.92)	10.7 (0.50)	10.5 (0.66)
56 - 65	10.3 (0.90)	10.0 (0.95)	9.5 (0.60)	9.5 (0.70)
66 - 75	10.6 (0.66)	10.4 (0.80)	9.9 (0.45)	9.1 (0.20)
Mean	10.8cm	10.4cm	10.5	10.2
Total				

In Table 3, the calculated mean values of the renal length obtained after serial measurements are shown together with the corresponding age and sex distribution. The mean renal lengths obtained were 10.7cm and 10.5cm for left and right kidneys respectively for the males. Those for the females were 10.5cm and 10.2cm for the left and right kidney respectively.

**Table 4:** Mean renal length and corresponding anthropometric parameters

Renal Length R(cm)	Body Height L(cm)	Body Weight Mean (cm)	Body Weight Mean (kg)	Renal Length	
				R(cm)	L(cm)
10.3	11.0	$153 \pm 2.00$	$45 \pm 2.00$	9.7	9.9
10.9	10.6	$158 \pm 2.00$	48	10.2	10.5
10.7	10.9	$163 \pm 2.00$	53	10.2	10.7
10.3	11.1	$168 \pm 2.00$	58	10.4	10.6
10.8	10.9	$173 \pm 2.00$	63	10.4	10.7
10.6	11.2	$178 \pm 2.00$	68	10.3	10.9
-	-	-	73	11.0	11.2
-	-	-	78	10.4	11.0
-	-	-	83	10.8	11.0

Table 4 shows the mean renal lengths and the weights and heights of the corresponding patients. Using the least square method, a correlation between the kidney lengths and body weight yielded coefficients of 0.83 and 0.98 for the left and right kidneys respectively. The same test between the kidney length and body height yielded correla-

tion coefficients of  $r = 0.38$  and  $0.17$  for the left and right kidneys respectively. The coefficients of correlation were  $0.17$  and  $0.35$  between the right and left kidneys respectively.

## Discussion

Sonographic evaluation of renal size has been found to be superior to conventional radiography due to the absence in the former of geometric distortions [4]. The fact that no biological damage has been associated with sonographic investigations at diagnostic intensity is also an added advantage. Other advantages include its repeatability and promptness. Currently, ultrasonography is the most commonly used modality for assessing renal size. Renal length is said to be the best parameter for assessing renal size, as it has been found to have the least observer variation, [6,7,8] and to be the most clinically practicable. In addition, its measurement is independent of position [8] and is the best for estimating renal weight [8].

A normogram of renal length has been established for the locality by this study with mean renal length of 10.6cm and 10.3cm for the left and right kidneys respectively. These values are slightly lower than Caucasian



values of 11.2cm and 10.71 from the study of Emamian *et al.* [9]. The differences are however not statistically significant  $P < 0.05$ . There is thus no racial dependence of renal length from this study - an observation which is similar to earlier findings.

The left kidneys in this study were slightly longer than the right similar to the findings of Emamian *et al.* [9]. This may be explained by the relatively small size of the spleen on the left against a large liver on the right, with the former allowing longer vertical growth for the left kidney. There was statistically significant difference between the renal length of males and that of the females, in agreement with Emamian *et al.* [9] and Ozo *et al.* [5] who also noted sex differences. The mean renal length of the males was higher than that of the females. This may be due to the larger average body size of the males. The positive correlation with body weight seems to substantiate this line of thought. Renal length in this study correlated positively with body weight  $r = 0.98$  but not with body height,  $r = 0.17$ . This is similar to the findings of the study by Loftus *et al.* [10], who also did not find differences in renal length between the Asians and the Caucasians despite differences in body height.

The range of values obtained for the renal length is 8.3 – 12.8cm for the left and 8.0cm – 12.5cm for the right. These will serve as a guide in assessing renal size especially when the presenting renal pathology is bilateral. If the presenting renal disease is however unilateral, the confidence interval between the left and the right becomes very useful. In that case, if the right kidney length of a patient within the 16-25 years were shorter than the left by more than 0.18cm (i.e 0.58-0.4) an index of suspicion should be raised for pathology.

There was weak correlation between renal length and the age of the subjects with  $r = 0.17$  and  $0.35$  for the right and left kidneys respectively. The non-correlation of renal length with age may be as a result of sinus lipomatosis which compensates for parenchymal thinning that occurs with age [2,4]. However the non-inclusion of lower age groups (<16 years) may have influenced the lack of age dependence of the renal length since, it is at this age group that significant growth spurts occur.

## Conclusion

The mean values of the renal length kidney obtained sonographically were 10.7 and 10.5cm for the left and right kidneys respectively in males. Those for the females were slightly lower, 10.5cm and 10.2 cm for the left and right kidneys respectively. Renal length correlated positively with body weight and not with patient height or age.

## References

1. Khan CB, Raman PG and Zic S. Kidney size in diabetes mellitus. *Diabetes* 1974; 23(a): 788 – 792.
2. Magensen CE and Anderson MJF. Increased Kidney size and glomerular filtration rate in early Juvenile diabetes. *Diabetes* 1973; 22: 706 – 712.
3. Frick MP, Feinberg SB and Sibley P. 'Ultrasound in acute renal transplant rejection. *Radiology* 1981; 138:657- 660
4. Zerin JM and Blane CE. "Sonographic assessment of renal length in children": a reappraisal. *Paed Radiol* 1994; 24(2): 101 - 106
5. Ozo JO, Okoye IJ, Umerah BC, Onuigbo MAC and Nwagbo DFE. Normal renal size in Nigerians. *WAJR* 1992; 2(1): 5 - 110
6. Brandt TD, Neiman HL, Dragowski MJ, Bulawa W, and Claykamp G. Ultrasound assessment of normal renal dimension. *J Ultrasound Med* 1982; 1: 49 -52
7. Dinkel E, Ertal M, Peters H, Berres M and Schulte, Wissermann. Kidney size in children: Sonographic growth for kidney length and volume. *Radiol* 1985; 15: 38 -43
8. Spiegel G, Jearty P, Kittel F and Struyven S. Ultrasonic measure of normal kidney, *J Belge Radiol* 1982; 65: 513 - 518
9. Emamian SA, Nielsen MB, Pedersen JF, Ytte L and Kidney dimensions at sonography: Correlation with age, sex and habitus in 665 adult volunteers. *AJR* 1993; 160: 83 - 86
10. Loftus WK, Gert RJ, Lequesue GW and Metrewel C. Renal length in Chinese children: Sonographic measurement and comparison with Western data. *J Clin. Ultrasound* 1998; 26(7): 349 –352.

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