

Ultrasonographic Assessment of Renal Length with Respect to Age and Sex: A Hospital Based Study

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ABSTRACT

Introduction: Kidney is an important retroperitoneal organ with excretory and endocrine functions. The length of kidney is affected in variety of clinical disorders with age. **Aims:** The aim of the study was to determine the renal length with respect to individual's sex and age. **Methods:** This study was conducted on 369 patients referred to department of Radiology for abdominal ultrasonographic examination where renal length was measured and recorded. **Results:** The mean right kidney length was found to be 9.3403 cm and the left mean kidney length was found to be 9.3490 cm. In comparison among male and female, males were found to have a greater mean kidney length. The maximum mean right kidney length was found in 50-59 years age groups while left kidney length was found maximum in 30-39 years age group. **Conclusion:** We performed ultrasonographic assessment of renal length with respect to age and sex in Nepalese population. We found that the kidney length of both left and right kidneys was related to age and sex.

Keywords: Age, Dimension, Kidney, Sex, Ultrasonography

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INTRODUCTION

Kidneys are a pair of excretory organ situated on the posterior abdominal wall, one on each side of vertebral column behind the peritoneum. The right kidney is usually slightly inferior to the left, reflecting its relationship to the liver. In adults, each kidney is typically 11cm in length, 6cm in breadth and 3cm in antero-posterior dimension. The left kidney may be 1.5cm longer than the right; it is rare for the right kidney to be more than 1cm longer than the left. The average weight is 150gm in men and 135gm in women.¹ Regarding the functions of kidney, kidney plays an essential role in excreting end products of metabolism and excess water thus maintaining electrolyte and water balance. Apart from this kidneys also have endocrine functions like secretion of erythropoietin, renin, 1.25-di-hydroxycholecalciferol.² The size of kidney is affected in variety of clinical disorders such as diabetes, renal artery stenosis, chronic hypertension and chronic renal failure. It has been observed that most important measurement of renal size is longitudinal renal length.³ The aim of this study was to help establish standardized data of normal renal length in our population and also to investigate effect on its measurement according to gender and age.

METHODS

This is a hospital based cross-sectional study which was conducted in Nepalgunj Medical College from October 2021 to March 2022. The analysis was done in Department of anatomy and the required data for present study was collected from Department of Radiology. The sample size was calculated and it was 369. Abdominal Ultrasonographic examination was performed using E-CUBE8 ALPINION to measure renal lengths of both sides. The study was conducted only after taking informed consent from each individuals and ethical clearance was obtained from the institutional review committee. Subjects who were referred for abdominal ultrasonography imaging were included in this study. Those individuals with prior history of renal surgery or any current or past renal pathology, obstetric and maternal scan were excluded from the study.

The data for this study was carefully tabulated and analyzed with the help of SPSS. For different variables in the study, appropriate descriptive measures like minimum, maximum,

mean, standard deviation were determined. For within group comparison (two groups), paired sample t-test was used. Similarly, for between group comparison (two groups),

independent sample t-test was used. Anova test along with post-hoc test was used for making comparison among more than two groups.



Figure 1: Showing measurement of kidney length

RESULTS

A total of 738 kidney units in 369 patients were analyzed of all age groups. The majority were lying between 19-29 years age group. The mean length of right kidney was found to be 9.3403 cm with the standard deviation of 1.0292 cm and mean length of left kidney was found to be 9.3490 cm with a standard deviation of 0.9937 cm. The difference between right kidney length and left kidney length among the study subjects was not significant (p= 0.782). This analysis is represented in Table I.

	N	Min	Max	Mean	Std. Deviation	p value
Right kidney length	369	5.90	12.19	9.3403	1.0292	0.782
Left kidney length	369	6.5	12.5	9.3490	0.9937	

Table I: Summary statistics of length (in cm) of all kidneys in the study

The difference between the right and left kidney length in female was not found to be significant. The difference between right and left kidney length in males was also not found significant. However when right kidney length between male and female was compared it was found to be significant (p<<0.01). The same was true for left kidney length (p<<0.01)

Sex	Kidney length (in cm)		Within sex comparison (p value)
	Right	Left	
Male	9.8230±1.1027	9.7157±1.0635	0.056
Female	9.1559±0.9382	9.2089±1.0635	0.158
Between sex comparison (p value)	(<<0.01)	(<<0.01)	

Table II: Comparison of kidney (in cm) by sex

The length of left and right kidney was compared with different age groups. It was observed that the mean length of right kidney was maximum in age group 50-59 years and minimum in age group <=18 years and mean length of left kidney was maximum in age group 30-39 years and minimum in age

group<=18 years. When right kidney length was compared among different age groups, it was found to be significant (p<<0.01). Similarly left kidney length was compared among different age groups and was also found to be significant (p<<0.01). The result is shown in Table III

	Age group	Min	Max	Mean	Std. Dev	Total	p value
Right Kidney Length	<=18	7.20	11.29	8.7495	1.04319	22	<<0.01
	19-29	7.10	11.80	9.1161	0.89670	135	
	30-39	6.80	11.76	9.5276	0.95614	89	
	40-49	6.45	12.19	9.5671	1.09216	62	
	50-59	7.90	11.80	9.7112	1.05275	33	
	60-69	7.50	11.27	9.4580	0.94009	15	
	>=70	5.90	11.59	9.2269	1.64542	13	
Left Kidney Length	<=18	6.50	10.88	8.7245	1.07860	22	<<0.01
	19-29	6.50	11.30	9.1591	0.89023	135	
	30-39	6.70	11.80	9.5857	1.01755	89	
	40-49	7.45	12.15	9.5671	0.95935	62	
	50-59	7.60	11.57	9.5588	0.87528	33	
	60-69	7.90	11.29	9.3340	0.96415	15	
	>=70	6.50	11.88	9.2762	1.43566	13	

Table III: Comparison of Kidney length (in cm) with respect to age group (in years)

By applying post-hoc test significant differences between specific age group were determined both for left kidney length and right kidney length. The pair of age groups in which difference was found to be significant is shown in Table IV.

Kidney	Different age groups (in years)	Mean difference (in cm)	p value
Left kidney	<=18 and 30-39	-0.8611	0.004
	<=18 and 40-49	-0.8425	0.009
	<=18 and 50-59	-0.8342	0.031
	19-29 and 30-39	-0.4338	0.020
Right kidney	<=18 and 30-39	-0.7780	0.021
	<=18 and 40-49	-0.8175	0.019
	<=18 and 50-59	-0.9616	0.010
	19-29 and 30-39	-0.4115	0.045
	19-29 and 50-59	-0.5951	0.039

Table IV: Result of post-hoc test showing pairs of age groups with significant difference

DISCUSSION

In this study, we analyzed renal size in terms of kidney length in Nepalese population. Renal size is a very important and easily reproducible parameter as an indicator of renal function that shows variations with age, sex, height, weight and BMI. Kidney sizes are altered by renal diseases which also cause a resultant change in the normal organ structure. Kidney measurements by using ultrasonography is an important method in studying renal

disorders, and it offers the advantage of being a noninvasive method.⁵ In our study, we observed that the kidney length of males were greater than their female counterparts irrespective of side. This observation shows resemblance with the findings of previous workers. In present study, we found that left kidney size was greater than the right kidney size which shows the resemblance with findings of previous studies of Badu M et al⁶, Raza M et al⁷, Purohit K et al⁸, Yadav SK et al⁴, Mansur DI et al⁹, Okur A et al¹⁰ and Srivastava A et al.³ They and Harmse WS¹¹ also found that kidney size of males were larger than females except Badu M et al⁶ who studied only on females. This finding also resembles with the finding of our study.

The present study shows that the maximum mean value of right kidney was found in 50-59 years age group and in left kidney it was found in 30-39 years age group, whereas Purohit K et al⁸ and Srivastava A et al³ found the maximum values in 41-50 and 21-30 years age groups respectively. The minimum mean value of right and left kidney length of our present study was found in <=18 years age group whereas Purohit K et al⁸ found minimum values in <10 years which is similar to our study, but Srivastava A et al³ found minimum value in >50 years age group. The right and left mean kidney length in our present study in <=18 years age group was found to be 8.7495 ± 1.04319 cm and 8.7204 ± 1.07860 cm respectively which shows a greater value than Mansur DI et al⁹ which were 7.05 ± 1.80 cm and 7.36 ± 1.89 cm respectively. For left kidney length, difference was found to be significant between <=18 years and 30-39 years age group, <=18 years and 40-49 years age group, <=18 years and 50-59 years age group and 19-29 years and 30-39 years age group.

Similarly for right kidney length difference was found to be significant between <=18 years and 30-39 years age group, <=18 years and 40-49 years age group, <=18 years and 50-59 years age group, 19-29 years and 30-39 years age group and 19-29 years and 50-59 years age group.

LIMITATIONS

The major limitation of the study was that the other parameters like body weight, cortical thickness, kidney volume etc were not included. Therefore the study of kidney length including various parameters is required to give a conclusive opinion regarding the importance of this type of study in clinical practice.

CONCLUSION

This study has provided measurements of kidney length in normal persons without known disease in Nepalese population. We report that the kidney length in male population is larger than in female population. We found that the kidney size increases till third decade, remains stable through middle age and then decreases. Similarly, we also found that for both left and right kidneys, kidney length for lower age group was significantly different compared to higher age groups while kidney length among higher age groups was almost similar. Furthermore, this may serve as a baseline tool for early diagnosis and intervention in different renal pathology.

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