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Sonographic Assessment of Renal Size among Young Population of District Mardan, Pakistan: A Cross Sectional Study

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ABSTRACT

Background: The kidneys are two reddish-brown organs positioned towards the upper region of the posterior of the wall of the abdomen, with one on both sides of the vertebral column. Renal ultrasound has been the preferred method for measuring kidney dimensions because it is readily accessible and does not involve the use of ionizing radiation. The objective was to measure and assess the sizes of kidneys using ultrasonography.

Material and Methods: Three hundred and eighty five individuals of both genders were selected randomly. These individuals were examined in the department of radiology Mardan Medical Complex using an ultrasound machine. By utilizing the statistical program SPSS (version 22), the Pearson correlation was used for weight, height, age and body mass index.

Results: The overall mean length of right kidney was 9.68cm±0.86, width of right kidney was 4.54cm±0.51, and its parenchymal thickness was 2.57cm±0.29. Left kidney overall mean length was 9.86cm±1.01, width of left kidney was 4.73cm±0.55 and its parenchymal thickness was 2.69cm±0.28. Gender showed notable changes in renal length, width along with their parenchymal thickness with $p<0.001$.Age group analysis showed a noteworthy increase in the kidneys width, thickness, and their length up to fifties. Positive correlation was noted between renal length, parenchymal thickness, and body height, body weight and BMI.

Conclusions: In this study, the mean renal length was found to be slightly lower compared to other populations. Men generally had larger kidney sizes compared to women. The study also observed age-related changes in renal length, with an increase in length up to the age of fifty. These findings will help in the diagnosis and management of renal diseases.

Keywords: Sonography, Renal Size, Young Population, District Mardan

INTRODUCTION

The kidneys are two reddish-brown organs positioned towards the upper posterior region of the wall of the abdomen, with one on each side of the vertebral column. The location of right kidney is mildly lower in a level with comparison to the left one (due to bulk of right lobe of liver). Both kidneys displace round about 1 in. or (2.5 cm) in superior-inferior direction during full respiratory movement of the diaphragm muscle.[1] The purpose of the kidneys is to remove waste materials from the blood and expel them from the body through urine.[2] The ultrasonic renal examination does not necessitate any patient preparation and is typically carried out with the patient lying on their back (supine position). The kidneys are examined from both the long and short sides using the transducer placed on the sides of the abdomen. If intestinal air makes it difficult to obtain clear images of the kidney, the patient may also be positioned on their side (lateral decubitus position) with the transducer adjusted to capture images from the back. Ideally, the examination begins with the longitudinal scan plane, aligned with the kidney's long axis, as this makes it easier to distinguish the kidney.[3] The size of the kidneys is crucial in clinical practice

for screening, diagnosing, and monitoring kidney diseases, forming the foundation for clinical decisions. Repeated measurements are valuable in assessing whether the disease is getting worse or remains stable.[4] Because many renal illnesses are associated with variations in kidney size, normative standards for measuring kidney size have been developed.[5] The assessment of renal measurements, including length, width, and thickness, using ultrasound imaging is a crucial dimension in the detection and monitoring of various kidney pathologies. This is because there is a significant connection between the size of the kidneys and their functioning.[2]

Renal size can be influenced by multiple factors; therefore it is initially essential to establish normal values.[6] It is shown by many studies that renal measurements and size have been affected by many factors i.e. age, gender, weight, height and ethnicity.[2] The assessment of renal size can be performed using different methods, including length and volume measurements. These measurements can be further adjusted with additional factors like age, height, weight, and ethnicity in a multivariate analysis.[7] It is also observed that the right kidney or kidney on the right side of the body is smaller than the left kidney, independent of gender.[2] The length of the kidneys is directly related to the height of the patient, so it is important to consider this when estimating the expected kidney length.[8]

MATERIALS AND METHODS

This was a cross sectional study conducted in the Radiology department of the tertiary care hospital Mardan Medical Complex, Mardan (KPK). It was a descriptive study from July 2023 to October 2023. For this study, the sample size was determined to be 385 participants. Convenience sampling was utilized in this study to select individuals from the target population.

Inclusion criteria: Healthy individuals aged 18-45 years.

Exclusion criteria: Pregnant or obstetric patients, Nephrolithiasis, Cardiovascular disorders, diabetics individuals, Hypertensive patients.

Ethical considerations were taken into account throughout the research process. Appropriate permissions and approvals were obtained, ensuring that the study was conducted in accordance with ethical guidelines and regulations. Data was collected through a pre designed questionnaire, it was handed over to each patient after consent and then a scan was performed through ultrasound machine equipped with a convex probe. Renal measurements were taken through an abdominal acoustic window and recorded. The procedure was applied to every individual. By utilizing the statistical software SPSS (version 22), the data was analyzed. Descriptive statistics were employed to provide a comprehensive description of the normal renal size. This involved calculating measurements such as mean, standard deviation, and range to summarize the data. To assess the relationship between normal renal size and various demographic factors such as age, gender, height, weight, and BMI, the Pearson correlation test was utilized. This statistical test assesses the significance and direction of the relationships between these variables. The findings of the data analysis were presented in a concise manner through the use of tables.

RESULTS

A total of 385 individuals were studied, categorized as 188 males (48.8%) and 197 females (51.2%).Furthermore, age was also categorized into four different groups. The first group having age of, 18 to 25 years, with a frequency of 110 (28.6%) the second group ranging from, 26 to 32 years, with a frequency of 111 (28.8%), the third group ranges from 33 to 40 years with a frequency of 105 (27.3%) and the last group belongs to those individuals that were between the age of 41 to 48 years having a frequency of 59 (15.3%). A P value of 0.57 was observed between the age of patients and gender (males and females) of the individuals (Table 1).

The analysis of data showed that mean right kidney length in males was 9.89cm with STD(Standard Deviation) of 1.04 and 9.47cm with STD of 0.59 in females. The mean left kidney length for males was noted as 10.06cm with STD of 1.14 while for the female,it was9.68cm with STD of 0.83. Mean width for the left kidney for males was noted 4.76cm with STD of 0.34 while for females it was 4.69cm with STD 0.69. Overall mean length of right kidney was 9.68cm with STD of 0.86, width of right kidney was 4.54cm with STD of 0.51, and parenchymal thickness was 2.57cm with STD 0.29. Left kidney overall mean length was 9.86cm with STD of 1.01, width of left kidney was 4.73cm with STD of 0.55, parenchymal thickness was 2.69cm with STD of 0.28 (Table 2). The study found that the mean length for right kidney across age groups was 9.68cm with STD of 0.87, thickness was 2.57cm with STD of 0.29, and that of width was 4.54cm with STD of 0.52 while the left kidney length was 9.87cm with STD of 1.02 while left kidney parenchymal thickness was noted 2.69cm with STD of 0.28 and that of width was 4.73 with STD of 0.55.

Table 1: Age of patients. * Gender of patients. Cross tabulation

Variable		Gender of patients.			P Value
		Male	Female	Total	
Age	18 to 25 (years)	53 (48.2%)	57 (51.8%)	110 (100.0%)	0.57
	26 to 32 (Years)	49 (44.1%)	62 (55.9%)	111 (100.0%)	
	33 to 40 (Years)	54 (51.4%)	51 (48.6%)	105 (100.0%)	
	41 to 48 (Years)	32 (54.2%)	27 (45.8%)	59 (100.0%)	
	Total	188 (48.8%)	197 (51.2%)	385 (100.0%)	

Table 1.2: Normal values for kidney length, width and parenchymal thickness, are classified

Gender		N	Range	Mean	SD
Male	RRL	188	4.2	9.897	1.0457
	LRL	188	1.4	4.767	0.3420
	RPT	188	1.2	2.563	0.2081
	LPT	188	1.2	2.654	0.1998
	RKW	188	1.2	4.718	0.3283
	LKW	188	1.4	4.767	0.3420
Female	RRL	197	3.6	9.477	0.5861
	LRL	197	7.6	4.698	0.6981
	RPT	197	2.7	2.579	0.3663
	LPT	197	1.9	2.739	0.3438
	RKW	197	3.6	4.372	0.5991
	LKW	197	7.6	4.698	0.6981
Total	RRL	385	4.4	9.682	0.8671
	LRL	385	7.6	4.732	0.5540
	RPT	385	2.7	2.571	0.2994
	LPT	385	1.9	2.697	0.2856
	RKW	385	3.6	4.541	0.5154
	LKW	385	7.6	4.732	0.5540

RRL= Right Renal Length, LRL= Left Renal Length, RPT= Right Parenchymal Thickness, LPT = Left Parenchymal Thickness, RKW= Right Kidney Width, LKW= Left Kidney Width

Table 3: Distribution of renal length, width, and parenchymal thickness according to age group (years)

Variables		N	Mean	Std. Deviation
Right kidney Length in cm.	18 to 25 (years)	110	8.892	.6947
	26 to 32 (Years)	111	9.888	.7107
	33 to 40 (Years)	105	9.934	.5517
	41 to 48 (Years)	59	10.320	.8792
	Total	385	9.682	.8671
Left kidney Length in cm.	18 to 25 (years)	110	8.946	.7431
	26 to 32 (Years)	111	10.282	.6926
	33 to 40 (Years)	105	10.147	.5315
	41 to 48 (Years)	59	10.310	1.4607
	Total	385	9.868	1.0184
Right kidney Width in cm.	18 to 25 (years)	110	4.233	.4316
	26 to 32 (Years)	111	4.683	.5665
	33 to 40 (Years)	105	4.722	.4195
	41 to 48 (Years)	59	4.524	.4542
	Total	385	4.541	.5154
Left kidney Width in cm.	18 to 25 (years)	110	4.396	.3553
	26 to 32 (Years)	111	4.889	.4380
	33 to 40 (Years)	105	4.888	.3860
	41 to 48 (Years)	59	4.783	.9253
	Total	385	4.732	.5540

Right kidney Thickness in cm.	18 to 25 (years)	110	2.495	.2862
	26 to 32 (Years)	111	2.575	.3297
	33 to 40 (Years)	105	2.581	.2458
	41 to 48 (Years)	59	2.688	.3163
	Total	385	2.571	.2994
Light kidney Thickness in cm.	18 to 25 (years)	110	2.597	.2847
	26 to 32 (Years)	111	2.733	.2947
	33 to 40 (Years)	105	2.706	.2649
	41 to 48 (Years)	59	2.802	.2543
	Total	385	2.697	.2856

Table 4: Comparison of current study findings with previously published literature

Name of author	Region	Mean Renal length	Mean Width	Mean Parenchymal thickness
Okoye IJ	Nigerian[14]	100.39	-	-
Muthusami P	South indian[20]	90.65	-	15.54
Mujahid raza	Pakistani's[21]	104.82	45.22	13.27
Glodny B	Austrian[18]	105.49	-	15.6
Kang KY	South korean[22]	100.35	-	-
Fernandes MM	Brazilian[17]	120.3	-	-
Arooj a	Malaysian[2]	90.8	-	-
Barton EN	Jamaica[15]	-	-	9.85
Our study	KPK Pakistan	9.7	4.63	2.63

DISCUSSION

Patients are hesitant to undergo a test because of the anxiety associated with intrusive investigations. Despite underestimation in renal dimensions, ultrasonography has been considered and chosen as a diagnostic method of choice among all imaging modalities in most clinical studies due to its non-invasiveness, safety, dependability, and ease of access.[9] The measurements of the kidney's length and renal thickness that were obtained with regard to inter- and intra-observer differences revealed that whether the left kidney or the right kidney is involved, the degree of divergence was consistent , as well as whether one or several ultrasound professionals are performing the measurements simultaneously. This shows that ultrasound is a reasonably precise method for measuring kidney length and renal thickness in normal adult kidneys.[9] Between individuals, there are variations in both metric and non-metric bodily features , and these variations are influenced by hereditary and environmental variables.[9]

Numerous variables like body mass index (BMI), height, age, and gender affect renal measurements, the evaluation of renal size should also be done on an individual basis.[10,11] In various demographics, depending on their age groups, gender, height, weight, and ethnic backgrounds, the average length of the kidney ranges from 97 to 112 mm.[12] In the current study, we used ultrasound to assess the size of kidneys in the district Mardan, Pakistan population specifically measuring renal length, width and parenchymal thickness. These metrics' evaluations are straight forward, repeatable, trustworthy, and impartial. Our study found that the mean renal length for our population was 97.77 mm, which was comparable to values from Mexico[13], Pakistan[11], Malaysia[2], Nigeria[14], and Jamaica[15] but slightly shorter than those reported for the Caucasian population[16], Brazilian[17], and Austrian populations.

We found that the left kidney had significantly greater parenchymal thickness, length, and width than the right side kidney.Similar findings have been reported in other studies .[2] However, it was observed that there were no significant changes between the right and left kidney length; but the right kidney was shorter in cortical thickness and compared to the left one. Buchholz NP et al.[11] observed men to have somewhat larger renal diameters in the majority of studies than of females that were performed in other countries, likely as a result of differences in height or body size. The changes in the kidney length with age were already noted in previous studies. In our study,an increase in renal length was noted, with the highest increase observed in the age group ranging from 41 to 48 years. An increase in mean renal length in males has been documented in previous studies up to 50

years of age. However, past research also noted that renal length decreases after the age of 60. [18] Renal measures that can provide predictive information on end stage renal disease were renal parenchymal thickness and width of the kidney.[19-22] This study has some limitations. The current study demonstrates the necessity for many healthy individuals in every age group and various Pakistani cultural backgrounds.

CONCLUSION

In this study, the mean renal length was found to be slightly lower compared to other populations. Men generally had larger kidney sizes compared to women. The study also observed age-related changes in renal length, with an increase in length up to the age of fifty. These findings will help in the diagnosis and management of renal diseases.

CONFLICT OF INTEREST

No conflict of interest

REFERENCES

1. Snell R. Clinical Anatomy by Regions, Ninth Edition [Internet]. Available from: http://thepoint.lww.com/snell9e
2. Arooj AA, Yeoh J, Supriyanto E. Comparison of renal size among different Ethnicities. Int J Biol Biomed Eng [Internet]. 2011;5(4):221–31. Available from: https://www.researchgate.net/publication/293683333
3. Hansen KL, Nielsen MB, Ewertsen C. Ultrasonography of the kidney: A Pictorial Review. Diagnostics. 2016;6(1).
4. Su HA, Hsieh HY, Lee C Te, Liao SC, Chu CH, Wu CH. Reference ranges for ultrasonographic renal dimensions as functions of age and body indices: A retrospective observational study in Taiwan. PLoS One. 2019;14(11):1–17.
5. Zerin JM, Blane CE. Sonographic assessment of renal length in children: A reappraisal. Pediatr Radiol. 1994;24(2):101–6.
6. Myint O, Myint T, Aye A, Thwe W, Soe T, San KK, et al. Normal Ultrasonographic Renal Length In Relation to Age , Sex , BMI and Serum Creatinine Level Among Students in University Malaysia Sabah. Iosrjournal. 2016;15(6):20–5.
7. Coombs PR, Lavender I, Leung MYZ, Woods JC, Paul E, Webb N, et al. Normal sonographic renal length measurements in an Australian pediatric population. Pediatr Radiol. 2019;49(13):1754–61.
8. Moses AA, Fernandez HE. Ultrasonography in Acute Kidney Injury. POCUS J. 2022;7(Kidney):35–44.
9. Emamian SA, Nielsen MB, Pedersen JF, Ytte L. Sonographic Evaluation of Renal Appearance in 665 Adult Volunteers. Acta radiol [Internet]. 1993 Jan 1;34(5):482–5. Available from: https://www.tandfonline.com/doi/abs/10.3109/02841859309175388
10. Alizadeh Z, Hosseini A, Abkenari SA, Jabbari M. Radiographic examination of the greater sciatic notch in determining the sex among Iranian people. Med Sci Law. 2013;53(2):85–9.
11. Buchholz NP, Abbas F, Biyabani SR, Afzal M, Javed Q, Rizvi I, et al. Ultrasonographic renal size in individuals without known renal disease. J Pak Med Assoc. 2000;50(1):12–6.
12. Alan S. Sonographic Measurement of Absolute and. (1):185–9.
13. Oyuela-Carrasco J, Rodríguez-Castellanos F, Kimura E, Delgado-Hernández R, Herrera-Félix JP. [Renal length measured by ultrasound in adult mexican population]. Nefrologia [Internet]. 2009;29(1):30—34. Available from: https://doi.org/10.3265/Nefrologia.2009.29.1.30.1.en.full.pdf
14. Okoye IJ, Agwu KK, Idigo FU. Normal sonographic renal length in adult southeast Nigerians. Afr J Med Med Sci [Internet]. 2005 Jun;34(2):129—131. Available from: http://europepmc.org/abstract/MED/16749336
15. Barton EN, West WM, Sargeant LA, Lindo JF, Iheonunekwu NC. A sonographic study of kidney dimensions in a sample of healthy Jamaicans. West Indian Med J [Internet]. 2000 Jun;49(2):154—157. Available from: http://europepmc.org/abstract/MED/10948856
16. Akpinar IN, Altun E, Avcu S, Tüney D, Ekinci G, Biren T. Sonographic measurement of kidney size in geriatric patients. J Clin Ultrasound. 2003;31(6):315–8.
17. Fernandes MMR, Lemos CCS, Lopes GS, Madeira EPQ, Santos OR, Dorigo D, et al. Normal renal dimensions in a specific population. Int Braz J Urol. 2002;28(6):510–5.
18. Glodny B, Unterholzner V, Taferner B, Hofmann KJ, Rehder P, Strasak A, et al. Normal kidney size and its influencing factors - A 64-slice MDCT study of 1.040 asymptomatic patients. BMC Urol. 2009;9.
19. McCarville MB, Luo Z, Huang X, Rees RC, Rogers ZR, Miller ST, et al. Abdominal ultrasound with scintigraphic and clinical correlates in infants with sickle cell anemia: Baseline data from the BABY HUG trial. Am J Roentgenol. 2011;196(6):1399–404.
20. Muthusami P, Ananthakrishnan R, Santosh P. Need for a nomogram of renal sizes in the Indian population-findings from a single centre sonographic study. Indian J Med Res. 2014 May;139(5):686–93.
21. Raza M, Hameed A, Khan MI. Ultrasonographic assessment of renal size and its correlation with body mass index in adults without known renal disease. J Ayub Med Coll Abbottabad. 2011;23(3):64–8.
22. Kang KY, Lee YJ, Park SC, Yang CW, Kim YS, Moon IS, et al. A comparative study of methods of estimating kidney length in kidney transplantation donors. Nephrol Dial Transplant. 2007;22(8):2322–7.