

Morphological and Morphometric Parameters of Human Kidneys - A Cadaveric Study

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Abstract

Background: The size of the kidney can be considered as an important indication for Congenital anomalies and in many clinical signs. **Aim:** to study the morphological and morphometric parameters of human kidneys in Andhra Pradesh. **Materials and Methods:** Fifty formalin fixed kidney specimens (Right-25; Left-25) obtained from cadavers with age range 55-60 years were utilized from the Department of Anatomy, Santhiram Medical College, Nandyal to study the morphological and morphometric parameters of human kidney specimens. The morphometric parameters like length, width, thickness and weight of the kidneys were measured and recorded. **Results:** The means of length, width, and thickness of the right kidneys were 7.63 ± 1.039 , 3.93 ± 0.431 , 2.62 ± 0.373 whereas left kidneys were 7.68 ± 1.004 , 3.96 ± 0.426 , 2.58 ± 0.396 in the present study. The mean weight of the right kidney was 126.92 ± 24.923 whereas the mean of left kidney weight was 131 ± 24.363 in the present study. The morphometric parameters like length, width, thickness, and weight were more in left kidney compared to right kidneys. The higher morphometric values were noted in the male kidney specimens when compared to female kidney specimens in the present study **Conclusion:** Morphometric parameters have a significant role in size, vascular diseases and congenital anomalies of human kidneys and possess greater clinical importance.

Keywords: Kidney, lobulation, morphometry.

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INTRODUCTION

The kidneys are reddish brown in colour and lie behind the peritoneum high up on the posterior abdominal wall on either side of the vertebral column; they are largely under cover of the costal margin. The right kidney lies slightly lower than the left kidney because of the large size of the right lobe of the liver [1]. Each kidney is approximately 11-14 cm in length, 6 cm wide and 4 cm thick and weighs about 120-150 grams [2]. The size of the kidney influenced by congenital anomalies, neoplasia, vascular diseases. The morphometric parameters alterations play a significant role in diagnosing kidney disease [3]. Renal morphometry and its importance were obtained from the radiological investigations like ultrasound, computed tomogram, and nuclear magnetic resonance but studies on anatomical aspects of renal morphometry are lack [4, 5]. The present study was aimed to study the morphological and morphometric parameters of human kidneys in Andhra Pradesh population.

MATERIALS AND METHODS

Formalin-fixed 50 kidneys (Right -25; Left-25) obtained from the cadavers with age range 55-60 years were utilized from the Department of Anatomy, Santhiram Medical College, Nandyal to study the morphological and morphometric parameters of human kidneys in Andhra Pradesh population (Figure-1). The morphological parameters like shape, size were noted and the morphometric parameters like length, width, and thickness of the kidneys by using vernier calipers and recorded. The length of each kidney measured as the distance from superior pole to inferior pole, the width of kidney considered as transverse diameter from medial border to lateral border of the kidney, and anteroposterior diameter of kidney considered as the thickness of the kidney by using vernier calipers. The weight of the kidneys was measured by using a digital weighing machine and recorded. The variation in the size of the kidneys, lobulation were included whereas cystic kidneys and exaggeration of hilum were excluded in the present study.

RESULTS

All the kidney specimens are bean-shaped on morphological observation in the present study. Two kidney specimens of the right side out 25 specimens showed lobulation whereas left kidneys were normal (Figure-2). The means of length, width, and thickness of the right kidneys were 7.63 ± 1.039 , 3.93 ± 0.431 , 2.62 ± 0.373 whereas left kidneys were 7.68 ± 1.004 , 3.96 ± 0.426 , 2.58 ± 0.396 in the present study. The mean weight of the right kidney was 126.92 ± 24.923 whereas the mean of left kidney weight was 131 ± 24.363 in the present study (Table-1). The morphometric parameters like length, width, thickness, and weight were more in left kidney compared to right kidneys. The mean of male right kidney parameters like length, width, thickness, and weight

were 7.82 ± 1.2335 , 4.00 ± 0.4667 , 2.66 ± 0.4289 , and 130.06 ± 28.3611 whereas male left kidneys were 7.86 ± 1.1758 , 4.03 ± 0.4369 , 2.67 ± 0.4415 , and 135.53 ± 28.0404 respectively (Table-2). The mean of female right kidney parameters like length, width, thickness, and weight were 7.35 ± 0.6059 , 3.82 ± 0.3675 , 2.57 ± 0.2830 , and 122.20 ± 19.0776 whereas female left kidneys were 7.41 ± 0.6367 , 3.85 ± 0.4062 , 2.46 ± 0.2913 , and 124.20 ± 16.5583 respectively. Two specimens of one large size and one smaller size right kidneys were also observed (Figure-3). We have also observed one left side kidney specimen with vascular variation (Figure-4). The higher morphometric values were noted in the male kidney specimens when compared to female kidney specimens in the present study.

Table-1: Morphometric parameters of human kidneys (L-Length; W-Width; T-Thickness)

S.No	Sex	Right Kidney				Left Kidney			
		L (Cm)	W (Cm)	T (Cm)	Weight(Gm)	L (Cm)	W (Cm)	T (Cm)	Weight (Gm)
1	Male	7.1	3.7	2.2	161	7.1	3.7	2.0	169
2	Male	6.9	3.4	2.1	128	7.1	3.3	2.2	134
3	Male	7.6	3.7	2.4	139	7.4	3.9	2.5	146
4	Male	6.3	3.2	2.1	118	6.4	3.4	2.0	122
5	Male	8.4	4.0	2.9	129	8.4	4.2	2.7	135
6	Male	9.6	4.8	3.2	171	9.4	4.7	3.0	173
7	Male	7.4	3.9	2.4	133	7.2	3.9	2.5	136
8	Male	8.3	4.1	2.7	140	8.5	4.3	2.7	143
9	Male	4.8	3.7	2.0	64	5.0	3.6	2.2	69
10	Male	9.1	4.9	3.1	121	9.2	4.8	3.3	129
11	Male	8.6	4.2	3.0	126	8.5	4.1	3.1	130
12	Male	8.1	3.9	2.8	109	8.4	3.8	2.9	116
13	Male	9.3	4.4	3.3	181	9.1	4.3	3.4	186
14	Male	7.8	3.9	2.9	102	8.0	4.1	2.7	109
15	Male	8.0	4.3	2.8	129	8.2	4.4	2.9	136
16	Female	7.2	3.6	2.4	116	7.3	3.5	2.3	123
17	Female	7.5	4.0	2.9	118	7.7	4.1	2.9	129
18	Female	7.0	3.7	2.7	126	7.2	3.9	2.5	132
19	Female	6.5	3.2	2.1	101	6.5	3.2	2.0	109
20	Female	8.0	4.0	2.4	129	8.2	4.0	2.3	123
21	Female	8.3	4.4	2.8	163	8.4	4.5	2.8	159
22	Female	7.2	4.0	2.2	126	7.1	4.1	2.2	129
23	Female	8.1	4.2	2.9	138	8.0	4.2	2.8	131
24	Female	6.9	3.7	2.6	104	6.8	3.5	2.4	101
25	Female	6.8	3.4	2.7	101	6.9	3.5	2.4	106
Mean		7.63	3.93	2.62	126.92	7.68	3.96	2.58	131
Standard Deviation		1.039	0.431	0.373	24.923	1.004	0.426	0.396	24.363

Table-2: Statistical Analysis

Morphometry		
Right kidney	Male	Female
Length	7.82 ± 1.2335	7.35 ± 0.6059
Width	4.00 ± 0.4667	3.82 ± 0.3675
Thickness	2.66 ± 0.4289	2.57 ± 0.2830
Weight	130.06 ± 28.3611	122.20 ± 19.0776
Left Kidney		
Length	7.86 ± 1.1758	7.41 ± 0.6367
Width	4.03 ± 0.4369	3.85 ± 0.4062
Thickness	2.67 ± 0.4415	2.46 ± 0.2913
Weight	135.53 ± 28.0404	124.20 ± 16.5583
	P<0.05	P<0.05



Fig-1: Distribution of Right and left human kidney specimens



Fig-2: Large sized, small sized kidneys specimens, both are of right side kidneys



Fig-3: Lobulated right kidney specimen



Fig-4: Kidney specimen with vascular variations on left side

DISCUSSION

We have measured all the morphometric parameters like length, width, and thickness of both the kidneys in both the sexes which were more in males than females [6]. The morphometric parameter values were higher on left kidneys than right kidneys either in males or females. The higher morphometric incidence due to the more blood supply to the left kidney than the right kidney [7]. The range of normal kidney length obtained were 8.3 -12.8 cm and 8.0- 12.5 cm for the left and right kidneys respectively [8]. The mean renal lengths of males were slightly higher than those of females, the morphometric findings in our study were in agreement with the literature [9] whereas the same was in contrast with previous literature [10]. The renal volume had higher on the left than the right kidney in hypertensive patients of both sexes and female hypertensive patients have smaller kidney size compared to males. The higher morphometric values of male kidneys in our study may be due to high vascularity to the kidney [11]. The weight and dimensions of the left kidney were larger than the right kidney [12, 13]. The morphometric parameters like length, width, thickness, and weight can vary of different geographical origin of the population [14]. Significantly higher values of morphometric parameters were noted in male kidney specimens compared to the female kidney specimens in the present study was observed which were similar to previous studies on the morphometry of human kidneys [7, 9, 12, 15].

CONCLUSION

Morphometric parameters have a significant role in size, vascular diseases and congenital anomalies of human kidneys and possess greater clinical importance.

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Conflict of Interest: NIL

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