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### Morphometric study of human cadaveric kidneys

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### Abstract

**Background:** Since kidney is a vital organ of human body, it should be a foremost subject of medical research. Kidneys are a pair of chief excretory organs which maintain the electrolyte and water balance and also serve as endocrine organs. Variations in the size of kidney are noted in many clinical conditions such as neoplasia, congenital anomalies, acute and chronic renal failure. So the knowledge of normal morphological parameters lays down a baseline for the diagnosis of various clinical conditions related to the kidney.

**Methodology:** The aim of the present study was to determine the renal parameters of human adult cadaveric kidney and compare the results with previous studies. A total of 50 human adult cadaveric kidneys were included in the present study. Morphometric features like weight, length, width, thickness were measured. Lobulations of the kidney were also noted.

**Results:** The average parameters of left sided kidneys

were more than the right sided kidneys. Lobulations were present in 3 right sided kidneys and 2 left sided kidneys respectively.

**Conclusion:** Morphometric study of human kidneys is important, as it is believed to possess clinical importance. Knowledge about the variations in morphological parameters is important to strengthen the current literature and improves the knowledge needed for surgical and radiological intervention.

**Keywords:** Kidney, Morphometry, Lobulations.

### Introduction

The kidneys are two bean shaped organs located on the right and left sides of the body of vertebrae<sup>1</sup>. Human kidneys are paired retroperitoneal organs situated on the posterior abdominal wall, one on each side of the vertebral column at the level of T12 to L3 vertebrae<sup>2</sup> and are a pair of chief excretory organs which maintain the electrolyte and water balance in human body and also serve as endocrine organ<sup>3</sup>. Normal adult kidney is bean shaped and has a length of 10-12 cms, breadth of

5-7cms and width of 3cms<sup>4</sup>. The left kidney is 1.5 cm longer than the right. The average weight of a kidney is 150 grams<sup>5</sup>. At birth, kidneys have a lobulated appearance but the lobulation disappears during infancy<sup>6</sup>. The objective of present study was to carry out morphometric study of human adult kidneys and compare it with the literature available. Study of the anatomical variations of kidney is important to improve the knowledge needed for surgical and radiological intervention.

### Materials and methods

Present study was conducted on 50 adult human cadaveric kidneys collected from the Department of Anatomy, Government Medical College, Jammu. Out of 50, 18 were right sided and 32 were left sided. Morphometric features studied were:

- 1) Weight in grams measured using electronic weighing machine.
- 2) Length in cms (maximum distance between the upper and lower pole of kidney)
- 3) Breadth in cms (maximum distance between two points at the same level between medial and lateral border)
- 4) Width in cms (maximum)

Length, breadth and width were measured using vernier calliper.

- 5) Presence of lobulations were noted

The data obtained was analysed statistically and compared with the previous studies.

### Results

All the kidneys were bean shaped. Among the 18 right sided kidneys, 3 kidneys showed presence of lobulations. Weight of right kidney ranged from 50.7gms to 180gms, average being 101.6gm. The length varied from 7.4cms -12.8cms, average length

was 11.7cms. The breadth was in the range 3.8cms-5.2cms, average being 4.1cms. Range of width was found to be 1.8cms-4.2cms and with an average of 2.8cms.

Among 32 left sided kidneys, 2 showed presence of lobulations. The weight of left kidney varied from 53gms-190.3gms and the average weight of left kidney was 109.7gms. The length of left kidney varied from 6.6cms-13.5cms. The average length of left kidney was 12.2cms. The breadth of left kidney varied from 4.0cms-5.4cms and average breadth being 4.9cms. Width of left kidney varied from 2.4cms- 4.3cms, average width being 3.2cms.



Fig 1: kidneys included in the study



Fig 2: showing the largest and the smallest kidney



Fig 3: kidneys showing lobulations

Parameters	Right kidney		Left kidney	
	Range	Average	Range	Average
Weight (gm)	50.7-180	101.6	53-190.3	109.7
Length (cm)	7.4-12.8	11.7	6.6-13.5	12.2
Breadth (cm)	3.8-5.2	4.1	4.0-5.4	4.9
Width (cm)	1.8-4.2	2.8	2.4-4.3	3.2

Table1: showing morphometric data of right and left kidneys

## Discussion

In the present study 50 human cadaveric kidneys were included. 18 were right sided and 32 were left sided. Various morphometric parameters as weight, length, breadth, width and presence of lobulations were noted. In the present study all the kidneys were bean shaped which is in accordance with many studies done in the past. The average weight of right kidney in the present study was 101.6gms, which is in concordance with

Agarwal R, Reddy P<sup>7</sup>, who found average weight of right kidney to be 102.54 gms. Okoye IJ et al<sup>8</sup> found the ranges of kidney length to be 8.3-12.8cms and 8.0-12.5 cms for the left and right kidney respectively. While the present study shows range of renal length to be 7.4-12.8cms and 6.6-13.5cms of right and left kidney respectively. Study done by Moore MS et al<sup>9</sup>, showed that average length of right and left kidneys to be 7.7-14cms with average 11.5cms and 8-14.5cms with an average of 12.71cms respectively, which is closer to the present study. Naik S et al<sup>10</sup> showed that the measurements of kidneys of left side were larger than the right side which is in accordance to the present study. Ashwini NS et al<sup>11</sup> found range of weight of right and left kidney to be 62.6 -170gm and 66.9-194.6 gm respectively. The average weight being 107.37 gm and 105.18 gm for right and left kidney respectively. They found the thickness of left and right kidney ranged from 3-4.6cms and 2.5-5cms with an average thickness of 3.85cms and 3.57cms respectively, which is not in accordance to the present study. Murlimanju BV et al<sup>12</sup> analysed 151 kidneys and stated that there was no stastical significance wiyh respect to the length of both the kidneys. Agarwal R and Reddy P found, 2 kidneys of right side and 4 kidneys of left side showed lobulation which is not in concordance to the present study. The morphometric parameter values were higher on left kidneys than right kidneys. The higher morphometric incidence due to the more blood supply to the left kidney than the right kidney<sup>13</sup>.

In the present study the dimensions of left sided kidneys were slightly more than the right sided kidneys.

## Conclusion

The variations in the morphological parametres of kidneys plays an important role to anticipate the clinical

conditions related to urinary tract diseases, congenital anomalies, renal neoplasias etc. It also helps to differentiate the healthy kidney from diseased kidney. So, the determination of renal anatomical variations should be simulated to support the current literature and improve the knowledge needed for surgical and radiological intervention.

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