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MORPHOMETRIC STUDY OF HUMAN ADLTY KIDNEY IN CADAVERS

Anatomy

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ABSTRACT

Introduction: One among the major essential functioning systems in the human body is the "Excretory System", which composed of a pair of kidneys the excretory organs. The other functions apart from excretion are serving as endocrine organ and also maintaining the electrolyte and water balance in the body. The various parameters of the kidney play an important role not only not only for cadaveric studies but also are indicators of various clinical conditions. Variations in the renal parameters may be due to neoplasms, congenital malformations, micro and macrovascular diseases. The deviated parameters alert us to be an important criterion to diagnose renal diseases.

Aim And Objectives: The present study aims to determine the various renal parameters and their variations

Material And Methods: The present study was carried out in the Department of Anatomy, Narayana medical college using 114 kidneys out of which 51 belong to right side and 63 belong to left side. The morphology and parameters of the kidney were documented, tabulated, photographed and also were also exhibited in the form of graphs.

Results: out of the 51 right kidneys, weight ranged from 65 to 165 gms with an average weight of 116.24 gms. The length of right kidneys varied from 6 to 11 cms with an average length of 8.81 cms. The breadth of right kidneys at superior pole was in the range of 3.80 to 5.70 cms with an average being 4. 79cms.The breadth of the right kidneys at inferior pole was in the range of 3.30 to 5.50 cms with an average being 4.55 cms. The thickness of right kidney ranged from 2.50 to 5. an average thickness of 3.51 cms. Among the 63 left kidneys, weight ranged from 6 to 20.20 gms with an average weight of 124.70 gms. The length of left kidney varied from 6.10 to 11.40 with an average length of 9.07 cms. The breadth of left kidneys at superior pole was in the range of 3.90 to 7.60 cms with an average being 5.29 cms. The breadth of left kidneys at inferior pole was in the range of 3.10 to 6.40 cms with an average being 4.49 cms. The thickness of left kidney ranged from 3.10 to 5.30 cms with an average thickness of 4.08 cms.

Conclusions: Morphometry of renal dimensions have high attention as they are believed to possess significant clinical importance. Determination of renal anatomical variants should be encouraged to strengthen the current literature to update the knowledge that is needed for the interventions which may be surgical or radiological.

KEYWORDS

Kidney Disease, Renal Parameters, Excretory Organs, Renal Transplant

INTRODUCTION

Kidneys are a pair of essential excretory organs, which elaborate urine and eliminate nitrogenous waste products of protein metabolism from the blood, and maintain electrolyte and water balance of the body (1). In addition, the kidneys secrete renin for autoregulation of blood flow and blood pressure, erythropoietin for maturation of red blood cells, and 1' – 25' hydroxycholecalciferol for the control of calcium metabolism which may modify the action of parathyroid hormone. Thus, the kidneys serve for the endocrine organs(2). Each kidney is situated retroperitoneally in the posterior abdominal wall by the side of the vertebral column, and extends from T12 – L 3. The kidneys are bean shaped and have two poles upper and lower, two surfaces anterior and posterior and two borders medial and lateral. Each kidney is 7.5 cms in length, 5 cms in breadth and 2.5 cms in thickness. The average weight of the kidney is 150 gms in males and 135 gms in females.Right kidney is slightly lower than its left partner due to the presence of the liver. Left kidney is longer, narrower and nearer to the vertebral column than the right one. the kidneys are placed in such a way that the upper poles are nearer to the midline than the lower poles. The upper poles are 2.5 cms away from the midline, the hila are 5 cms away from the midline and the lower poles are 7.5 cms away from the midline.

Morphometric studies of the kidney have attained utmost importance as well as clinical importance. It is necessity that the normal kidney has to be differentiated from the pathological kidney (4). Since the therapeutic decisions are often based on the results of measurements, accurate and reproducible normal parameters are of importance. Data are available in the literature on renal morphometry obtained from the radiological investigations like ultrasound, computed tomogram and nuclear magnetic resonance. Still the anatomical studies on renal parameters are scarce. Determination of renal anatomical variants will strengthen the current literature and improve the knowledge needed for surgical and radiological intervention. This work should be encouraged as there was a recent study showing correlation between kidney size and kidney function in chronic renal disease. Conditions like systemic diseases, urinary tract diseases, congenital anomalies, neoplasia, micro and macrovascular diseases were reported to significantly influence kidney sizes dimensions could possess significant clinical value (3). Therefore, the main objective of this study was to carry out morphometric study of human adult cadaveric kidney specimens and compare the finding studies. Determination of renal anatomical variants should be greatly encouraged to strengthen the current literature and improve the knowledge needed for surgical and radiological intervention.

AIMS AND OBJECTIVES

The aim and objectives of the present study is to determine the length, breadth, thickness, weight, presence of exaggerated hilum, lobulations or cysts in human adult cadaveric kidneys.

MATERIALS AND METHODS

One hundred and ten human adult cadaveric kidneys (right 51 and 63 left) over a period of 5 years from the department of Anatomy, Narayana Medical College, Nellore, were included in this study. Kidneys were observed and studied with the help of

1) Digital Vernier callipers (cms)
2) Weighing machine (gms)
3) Morphology of the kidneys was studied with the features like length, breadth, thickness, and weight
4) Exaggerated hilum was also observed.

The maximum distance between the upper and lower poles of the kidneys was considered as its length. The maximum distance at the superior pole i.e., above hilum and inferior pole i.e. below the hilum between the medial and lateral borders was considered as its breadth at superior and inferior pole respectively and maximum width as the thickness of kidneys. The presence of exaggerated hilum, lobulations and cysts in the kidneys were also studied. The data obtained was tabulated and analysed statistically and photographed.

OBSERVATION AND RESULTS

The present study was done on 114 kidneys. All the kidneys were bean

shaped. Among which right 51 were right kidneys and 63 were left kidneys. Out of the 51 right kidneys, weight ranged from 65 to 165 gms with an average weight of 116.24 gms. The length of right kidneys varied from 6 to 11 cms with an average length of 8.81 cms. The breadth of right kidneys at superior pole was in the range of 3.80 to 5.70 cms with an average being 4. 79cms.The breadth of the right kidneys at inferior pole was in the range of 3.30 to 5.50 cms with an average being 4.55 cms. The thickness of right kidney ranged from 2.50 to 5. an average thickness of 3.51 cms. Among the 63 left kidneys, weight ranged from 6 to 20.20 gms with an average weight of 124.70 gms. The length of left kidney varied from 6.10 to 11.40 with an average length of 9.07 cms. The breadth of left kidneys at superior pole was in the range of 3.90 to 7.60 cms with an average being 5.29 cms. The breadth of left kidneys at inferior pole was in the range of 3.10 to 6.40 cms with an average being 4.49 cms. The thickness of left kidney ranged from 3.10 to 5.30 cms with an average thickness of 4.08 cms.

DISCUSSION

Kidney size is considered as an important Indication for many clinical signs It has been shown through previous studies that aging leads to a progressive decrease in kidney size, especially after middle age. The other influencing factors are age, ethnicity, gender, weight and height. A significant correlation between kidney size and kidney function has been observed in patients with chronic kidney disease (CKD) (6). The renal dimensions might also vary among population of different geographical origin (5). Tissue masses in the kidney found incidentally are increasing with the diffusion of imaging in cuts and the treatment has considerably changed over the past 20 years and Partial nephrectomy (PN) proves to be the standard due to its good results on the cancer and progress in surgical techniques. Satheesh Naik et al showed the measurements of kidneys wherein he observed that weight and dimensions of left kidney were larger than the right kidney (7).

In the present study among the right kidney weight ranged from 65 to 165 gms with an average weight of 116.24 gms. In a study done by Ashwini N.S. et. Al., 2017 weight ranged from 62.6 to 170 gms with an average weight of 107.37 gms. In a study done by Manish et, al., 2015 the weight ranged from 59.2 to 197.1 with an average weight of 102.48. compared to these two studies the kidney weight is high in the present study. Kidney size is considered as an important indication for many clinical signs and hence it is worth studying. Previous studies showed that aging leads to a progressive decrease in kidney size, especially after middle age. Other influencing factors are many factors such as age, ethnicity, gender, weight and height (Table 1 , Graph 2).

The length of right kidneys varied from 6 to 11 cms with an average length of 8.81 cms. The breadth of right kidneys at superior pole was in the range of 3.80 to 5.70 cms with an average being 4. 79cms.The breadth of the right kidneys at inferior pole was in the range of 3.30 to 5.50 cms with an average being 4.55 cms. The thickness of right kidney ranged from 2.50 to 5. an average thickness of 3.51 cms. The length of right kidney varied from 7.7 to 14 cm with an average of 11.5 cm and the length of left kidney ranged from 8 to 14.5 cm with an average of 12.71cm. The breadth of right kidney varied from 3 to 8 cm with an average of 5.325 cm and the breadth of left kidney ranged from 3.5 to 8 cm with an average of 6.07 cm. The thickness of right kidney varied from 2 to 4.8 cm with an average of 3.32 cm and the thickness of left. The length of right kidney varied from 7.7 to 11 cms with an average length of 9.22 cms. The breadth of right kidneys at superior pole was in the range of 4 to 5.4 cms with an average being 4. 89cms.The breadth of right kidneys at inferior pole was in the range of 4 to 6.2 cms with an average being 4. 91cms.The thickness of right kidney ranged from 3 to 4.6 cms with an average thickness of 3.85 cms (7,8,9,10,11). This was by the study of Manisha et.al., 2015 (13).

In the study done by Ashwini N.S. et. Al., (2015) (14), the length of right kidney varied from 7.7 to 11 cms with an average length of 9.22 cms. The breadth of right kidneys at superior pole was in the range of 4 to 5.4 cms with an average being 4.89cms. The breadth of right kidneys at inferior pole was in the range of 4 to 6.2 cms with an average being 4.91cms. The thickness of right kidney ranged from 3 to 4.6 cms with an average thickness of 3.85 cms. Among the 45 left kidneys, weight ranged from 66.9 to 194.6gms with an average weight of 105.18 gms. The length of left kidney varied from 7.6 to 11.5 cms with an average length of 9.29 cms. The breadth of left kidneys at superior pole was in the range of 3.8 to 6.3 cms with an average being 4. 91cms.The breadth of left kidneys at inferior pole was in the range of 3.4 to 6 cms with an average being 4.57 cms. The thickness of left kidney ranged from 2.5 to 5 cms with an average thickness of 3.57cms. kidney ranged from 2 to 5 cm with an average of 3.64 cm.

In the present study, the length of right kidneys varied from 6 to 11 cms with an average length of 8.81 cms. The breadth of right kidneys at superior pole was in the range of 3.80 to 5.70 cms with an average being 4. 79cms.The breadth of the right kidneys at inferior pole was in the range of 3.30 to 5.50 cms with an average being 4.55 cms. The thickness of right kidney ranged from 2.50 to 5. an average thickness of 3.51 cms. Among the 63 left kidneys, weight ranged from 6 to 20.20 gms with an average weight of 124.70 gms. The length of left kidney varied from 6.10 to 11.40 with an average length of 9.07 cms. The breadth of left kidneys at superior pole was in the range of 3.90 to 7.60 cms with an average being 5.29 cms. The breadth of left kidneys at inferior pole was in the range of 3.10 to 6.40 cms with an average being 4.49 cms. The thickness of left kidney ranged from 3.10 to 5.30 cms with an average thickness of 4.08 cms Table 1,2, Graph 3). The mean lengths were slightly higher than those of females (14). There was no difference in width between right or left kidneys in the group as a whole or within either gender (15). There are quiet variations in these parameters and this may also be due to population of different geographical origin. Only 3 of the right kidneys had exaggerated hilum and 6 of the left kidneys had exaggerated hilum (Fig.3). Only 8 of the right kidneys were lobulated and 10 of the left kidneys were lobulated(Fig4). 3 of the right and left kidneys had cysts ranging from number 1-4(Fig.2)

CONCLUSIONS:

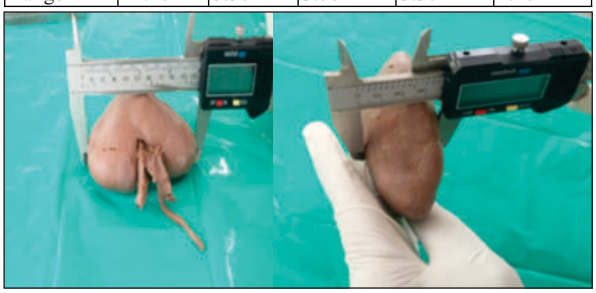
In the present study done by us and compared to the results of various authors, it has been observed that morphological parameters are utmost importance. Renal parameters play a significant role to differentiate between normal kidney and pathological kidney. This study not only added to the current literature but is also can help to improve the knowledge of the anatomist, radiologist and surgeons.

Table 1: Morphometric Data Of Right Kidneys (N=51)

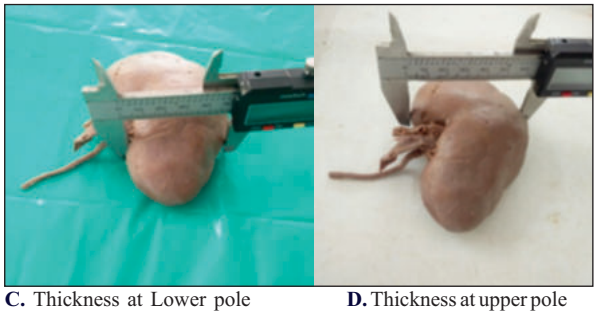
parameters	Right Kidney				
	Weight in gms	Length in cms	Breadth at superior pole in cm	Breadth at inferior pole in cm	Thickness
Mean	116.24	8.81	4.79	4.55	3.51
Standard Deviation	26.15	11.56	5.75	5.47	5.58
Standard error of mean	3.66	1.62	0.81	0.77	0.78
Minimum	65.00	6.80	3.80	3.30	2.50
Maximum	165.00	11.00	5.70	5.50	5.10
Range	100	4.20	1.90	2.20	2.60

Table 2 : Morphometric Data Of Left Kidneys (N=63)

Parameters	Left kidney				
	weight in gm	Length in cm	Breadth at superior pole in cm	Breadth at inferior pole in cm	Thickness in cm
Mean	124.70	9.07	5.29	4.49	4.08
Std. Deviation	36.18	12.60	8.55	8.39	6.93
Std. Error of Mean	4.56	1.59	1.08	1.06	0.87
Minimum	6.00	6.10	3.90	3.10	3.10
Maximum	20.20	11.40	7.60	6.40	5.30
Range	14.20	5.30	3.70	3.30	2.20



A. Length **B.** Thickness



C. Thickness at Lower pole **D.** Thickness at upper pole

Fig: 1. Showing The Measurements Of Kidney Using Vernier Callipers

Fig: 2 Showing Multiple Cysts In Kidneys

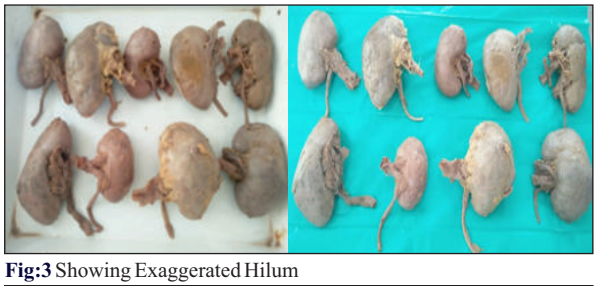


Fig:3 Showing Exaggerated Hilum

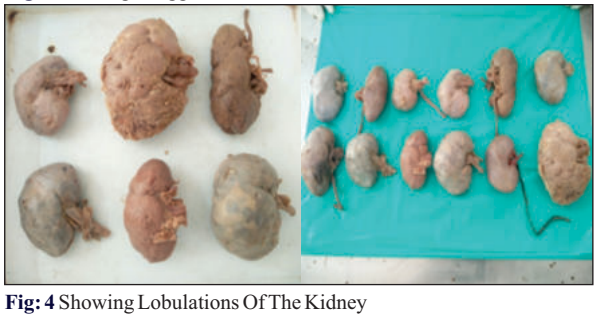


Fig: 4 Showing Lobulations Of The Kidney

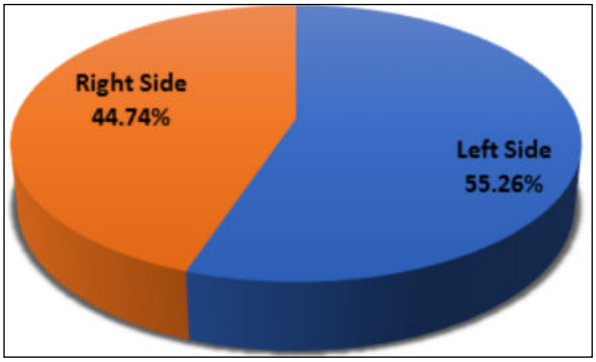


Fig: 1. Pie Diagram Showing The Percentage Of Right And Left Sided Kidneys

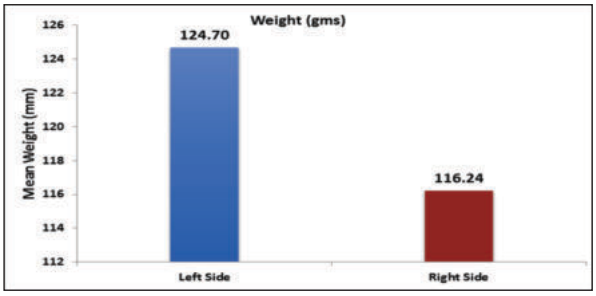


Fig:2 Graph Showing The Weight Of The Kidney

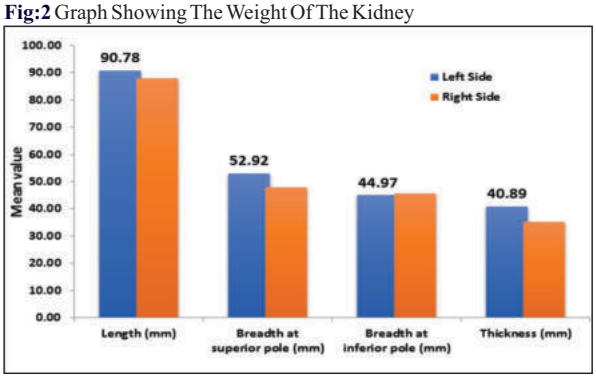


Fig: 3 Graph Showing The Various Parameters Of Kidney

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