

Morphometric evaluation of human cadaveric kidney

Dr. Ramanujam Singh

MBBS, MS, Professor, Department of Anatomy, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India

Abstract

There are few data available in the literature on renal morphometry which were obtained from the radiological investigations like ultrasound, computed tomogram and nuclear magnetic resonance. Therefore, the main objective of this study was to carry out morphometric study of human adult cadaveric kidney specimens and compare the finding studies.

The study had included the 100 kidney of human cadavers from Department of Anatomy, in Lord Buddha Koshi Medical College and Hospital, Saharsa. Total 100 kidney specimens were obtained out of which 50 are left kidneys and 50 are right kidney. Morphology of the kidneys was studied with the features like length, breadth, thickness, and weight. The arrangement of renal hilar structures was also observed.

Morphometric studies of renal measurements have extended much research consideration as they are supposed to own important clinical prominence. Determination of renal anatomical variations should be significantly stimulated to support the current literature and progress the knowledge desirable for surgical and radiological intervention.

Keywords: morphometric, human cadaveric kidney

Introduction

The kidneys are two bean-shaped organs found on the left and right sides of the body in vertebrates. They are located at the back of the abdominal cavity in the retroperitoneal space. In adults they are about 11 centimetres (4.3 in) in length. They receive blood from the paired renal arteries; blood exits into the paired renal veins. Each kidney is attached to a ureter, a tube that carries excreted urine to the bladder.

The nephron is the structural and functional unit of the kidney. Each adult kidney contains around one million nephrons. The nephron utilizes four processes to alter the blood plasma which flows to it: filtration, reabsorption, secretion, and excretion. Via one or more of these mechanisms, the kidney participates

in the control of the volume of various body fluid compartments, fluid osmolality, acid-base balance, various electrolyte concentrations, and removal of toxins. Filtration occurs in the glomerulus: one-fifth of the blood volume that enters the kidneys is filtered. Examples of substances reabsorbed are solute-free water, sodium, bicarbonate, glucose, and amino acids. Examples of substances secreted are hydrogen, ammonium, potassium and uric acid. Examples of substances that are excreted are urea, ammonium, and uric acid. The kidneys also carry out functions independent of the nephron. For example, they convert a precursor of vitamin D to its active form – calcitriol – and synthesize the hormones erythropoietin and renin.

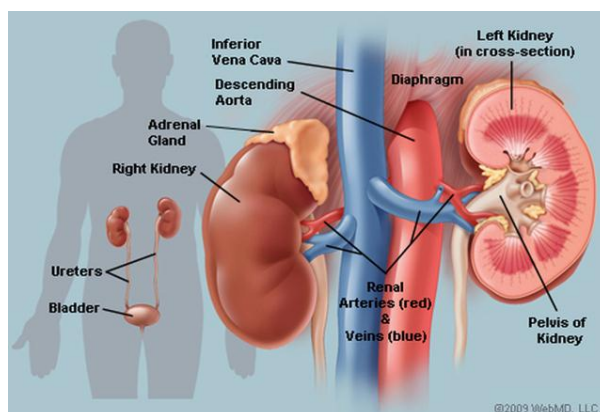


Fig 1

Renal physiology is the study of kidney function. Nephrology is the medical specialty which addresses diseases of kidney function: these include chronic kidney disease, nephritic and nephrotic syndromes, acute kidney injury, and pyelonephritis. Urology addresses diseases of kidney (and urinary tract) anatomy: these include cancer, renal cysts, kidney stones and

ureteral stones, and urinary tract obstruction [1].

There are few data available in the literature on renal morphometry which were obtained from the radiological investigations like ultrasound, computed tomogram and nuclear magnetic resonance. But the anatomical studies on renal parameters are scarce. Determination of renal anatomical

variants should be greatly encouraged to strengthen the current literature and improve the knowledge needed for surgical and radiological intervention [2].

Therefore, the main objective of this study was to carry out morphometric study of human adult cadaveric kidney specimens and compare the finding studies.

Methodology

The study had included the 100 kidney of human cadavers from Department of Anatomy, in Lord Buddha Koshi Medical College and Hospital, Saharsa. Total 100 kidney specimens were obtained out of which 50 are left kidneys and 50 are right kidney. Morphology of the kidneys was studied with the features like length, breadth, thickness, and weight. The arrangement of renal hilar structures was also observed.

The approval of the Institutional Ethics Committee is taken for the present study. The information was collected and discussed in following sections.

Results and Discussion

The data from the 100 kidney specimens of 50 left and 50 right kidneys were collected in the predesigned format and presented as below.

Table 1: Measurements of the Right and Left Kidneys

	Right Kidney	Left Kidney
Length (cms)	7.4 – 13.9	7.9 – 14.2
Breadth (cms)	3 – 8.5	3.5 – 8.5
Thickness (cms)	2.5 – 5	2 – 5.8
Weight (gms)	60 – 195	65 - 203

The length of the right kidney ranges from 7.4 to 13.9 cm and left kidneys ranges from 7.9 to 14.2 cm. The breadth of the right kidney was observed as 3 to 8.5 cm and left kidney as 3.5 to 8.5 cm. The thickness of the kidney of right kidney was seen as 2.5 to 5 cm and as that of left kidney noted as 2 to 5.8 cm. The weight of the right kidney was monitored from 60 to 195 gm, whereas that of left kidney as 65 to 203 gms.

Table 2: Variations in Renal hilar structures

	Right Kidney	Left Kidney
Normalrenal hilarstructurearrangement (Antero-Posteriorly VAP) (%)	85	68
Variationin renal hilar structure arrangement (Antero-Posteriorly AVP)(%)	15	32

The hilum of the right kidney showed an arrangement of renal vein, renal artery and renal pelvis anterioposteriorly in 85% specimens. In contrast 15% specimens showed renal artery, renal vein and renal pelvis antero-posteriorly at hilum. The hilum of the left kidney showed an arrangement of renal vein, renal artery and renal pelvis antero-posteriorly in 68% specimens. In contrast 32% specimens showed renal artery, renal vein and renal pelvis anterioposteriorly at hilum.

The present study showed a variation in the weight of kidneys when compared with the earlier findings. 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 [3-4]. Other influencing factors are many factors such as age, ethnicity, gender, weight and height.

Barton EN *et al* conducted a sonographic study of 49 randomly selected healthy adult Jamaicans to establish a guide for renal dimensions in the population. There was no difference in width between right or left kidneys in the group as a whole or within either gender [5]. Okoye IJ *et al* studied the renal lengths of 200 adults with normal renal and cardiac to establish normative values of renal length for the locality and to correlate them with some anthropometric parameters. The ranges of normal kidney length obtained were 8.3 -12.8 cm and 8.0- 12.5 cm for the left and right kidneys respectively. The mean renal lengths of males were slightly higher than those of females [6].

Conclusion

Morphometric studies of renal measurements have extended much research consideration as they are supposed to own important clinical prominence. Determination of renal anatomical variations should be significantly stimulated to support the current literature and progress the knowledge desirable for surgical and radiological intervention.

References

1. Cotran RS, Kumar S, Vinay, Fausto, Nelson Robbins, Stanley L, Abbas Abul K. Robbins and Cotran pathologic basis of disease. St. Louis, MO: Elsevier Saunders, 2005. ISBN 0-7216-0187-1.
2. Glodny B, Unterholzner V, Taferner B, *et al*. Normal kidney size and its influencing factors – a 64-slice MDCT study of 1.040 asymptomatic patients. BMC Urology. 2009; 9(1):19. PMC 2813848 Freely accessible. PMID 20030823. doi:10.1186/1471-2490-9-19.
3. Khatun H, Sultana Z, Islam, N, Kibria, Chy, T. Morphological Study of the Kidney in Relation to Age. Bangladesh Journal of Anatomy. 2009; 7(1):19-21.
4. Miletić D, Fuckar Z, Sustić A, Mozetic V, Stimac D, Zauhar G. Sonographic measurement of absolute and relative renal length in adults J Clin Ultrasound. 1998; 26(4):185-9.
5. 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. 2000; 49(2):154-7.
6. Okoye IJ, Agwu KK, Idigo FU, Normal sonographic renal length in adult southeast Nigerians. Afr J Med Med Sci. 2005; 34(2):129-31.