



MACROSCOPIC-MORPHOMETRICAL STUDY OF KIDNEY AND ITS CLINICAL SIGNIFICANCE

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ABSTRACT

Introduction: Macroscopic-morphometrical study of human kidney provides various data like dimensions, length variation on coronal section, number of; pyramid, minor calyx, major calyx and renal sinus with clinical significance.

Materials and methods: Total 101 kidneys were dissected and macroscopically studied. Various data like weight, length, breadth, thickness, length of cortex and medulla, number of; pyramid, minor calyx, major calyx and renal sinus were observed and analyzed.

Results: In our study, range of weight of right and left kidney was 75-185 gm and 45-165 gm with their average weight 117.6 ± 24.71 gm and 131 ± 27.63 gm respectively. Range of length of right and left kidney was 6.8-12.3 cm and 6.9-11.9 cm with their average length 9.35 ± 1.07 cm and 9.5 ± 0.98 cm respectively. Range of breadth of right and left kidney was 4.4-6.3cm and 4.4-6.5 cm with their average breadth 5.3 ± 0.91 cm and 5.5 ± 0.62 cm respectively. Range of thickness of right and left kidney was 2.9-5.6 cm and 2.5-4.9cm with their average thickness 3.57 ± 0.65 cm and 3.68 ± 0.62 cm respectively. Range of; cortex, medulla of; right and left kidney were 0.4-1.2 cm, 0.9-1.7cm and 0.4-1.2, 1.2-2.8 cm with their average length of; cortex and medulla 0.77 ± 0.21 , cm, 1.82 ± 0.39 cm and 0.78 ± 0.25 cm, 1.79 ± 0.38 cm respectively. Range of number of; pyramid, minor calyx, major calyx and renal sinus of right and left kidney were 6-18, 2-10, 1-5, 12-10 and 6-13, 3-9, 1-5, 2-8 with their average number of; pyramid, minor calyx, major calyx, and renal sinus were 10 ± 3.6 , 2.3 ± 1.6 , 2 and 9 ± 2.6 , 2.3 ± 1.5 , 2 respectively. 6% and 8% in both lobulated kidneys (right and left), 2% in polycystic right kidney, and 92% in both normal kidneys. 66%, 70% and 34%, 30% were found normal and variation in hilar structures in both kidneys (right and left) respectively.

Conclusion: This study of kidney plays important role in improving the knowledge for pathologist, surgeons and radiologist.

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INTRODUCTION

Kidney is one of vital organ which works as; rid the body of waste materials that are either ingested or produced by metabolism, control the volume and composition of the body fluids and maintain electrolytes in the body, the balance between intake due to ingestion or metabolic production and output due to excretion or metabolic consumption. The kidneys play important functions by filtering the plasma and removing substances from the filtrate at variable rates depending on the needs of the body. The kidney is retroperitoneal excretory and endocrine organ in the posterior abdominal wall by side of the vertebral column, and extends from twelve thoracic vertebra to first lumbar vertebra. Each kidney has bean shaped has length of 12cm, breadth of 6cm and thickness of 3cm with 150-170 gm in adult male and 130- 150gm in adult female. It consists of two ends with thicker and more rounded upper end than lower end. The lateral border is concave whereas the medial border is characterized by convex in the upper and lower parts and a hilar in between them. Hilum consists of renal vein, renal

artery and renal pelvis before backwards. On the coronal section, each kidney presents two parts outer renal substance and inner renal sinus. The renal substances consists of outer cortex; presents renal columns and cortical arches inner medulla; presents about 8 to 18 renal pyramids, minor calyx and major calyx. Renal sinus is a cavity within the kidney communicates outside through hilum (Datta 2000). In recent, morphometric study has gained research attention as they are believed to possess significant clinical importance. Variation related to weight, dimensions in kidney and on its coronal section and macroscopic studies are anticipated to furnish better insight on anomalies. Apart from aging, instance condition like systemic kidney disease, congenital anomalies, neoplasia, macro and microvascular diseases are reported to significant kidney size. With advent of imaging small tumors are also being indentified. But studied in relation to macroscopic and dimensions, length variation on coronal section, number of pyramid, minor calyx, major calyx and renal sinus are limited in number and this study has to be explored with additional findings. Therefore, main objective of the study is to carry out macroscopic-morphometrical study of kidney and described their possible possible clinical significance.

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MATERIALS AND METHODS

The macroscopic-morphometrical study of human kidney was done in the department of anatomy, universal college of medical sciences, Bhairahawa, Nepal. Total 50 right human cadaveric kidneys and 50 left human cadaveric kidneys including 1 horse shoe kidney were collected. The shape of kidney was noted. The hilum of kidney was dissected and noted the structures at the hilum. The weight of the kidney was measured by using electronic weighing machine. Length, breadth and thickness of kidney were measured with help of vernier caliper. Length was considered in between upper pole and lower pole. Breadth and thickness were considered at maximum distance. Coronal section of kidneys was made. Length of cortex and medulla were measured with help of vernier caliper. Length of cortex was considered from surface of kidney to base of pyramid. Length of medulla was considered from base of pyramid to minor calyx. Numbers of minor, major and renal sinus were noted. The data obtained were tabulated and analyzed. Abnormality of kidney was studied



Figure 1. Lobulated left kidney showing; 1 upper pole, 2 lower pole, 3 lobe, 4 renal vein, 5 renal artery, 6 ureter



Figure 2. Polycystic left kidney showing; 1, 2, 3, 4 & 5 cysts on surface



Figure 3. Horse shoe kidney showing; 1 coeliac trunk, 2 superior mesenteric artery, 3 inferior mesenteric artery, 4 right kidney, 5 left kidney, 6 isthmus, 7 left ureter



Figure 4. Right kidney showing; 1 renal vein, 2 renal artery, 3 ureter



Figure 5. Right kidney showing; 1 renal artery, 2 renal vein, 3 ureter



Figure 6. right kidney showing on coronal section; **1**cortex, **2**medulla, **3**renal sinus, **4**minor calyx, **5**major calyx, **6**renal pelvis, **7**renal artery, **8**renal vein

RESULTS

Total 101 kidneys were taken for study, 50 were right kidneys, 50 were left kidneys and 1 was horse shoe kidney. All kidneys were bean shaped except 1 kidney was horse shoe shaped. Among 50 right kidneys, weight ranged from 75 gm to 185 gm and average weight was found to be 117.6 ± 24.71 gm (Table 1). The length of right kidney ranged from 6.8 cm to 12.3 cm, average length of the kidney was found to be 9.35 ± 1.07 cm (Table 1). The breadth of right kidney ranged from 4.4 cm to 6.3 cm, average breadth of the kidney was found to be 5.3 ± 0.91 cm (Table 1). The thickness of right kidney ranged from 2.9 cm to 5.6 cm, average thickness of the kidney was found to be 3.75 ± 0.65 cm (Table 1). The length of cortex of right kidney ranged from 0.4 cm to 1.2 cm, average length of cortex of the kidney was found to be 0.77 ± 0.65 cm (Table 1). The length of medulla of right kidney ranged from 0.9 cm to 2.7 cm, average length of medulla of the kidney was found to be 1.82 ± 0.39 cm (Table 1).

Table 1. Comparison of measurements in between right and left kidney

	Right Kidney			Left Kidney		
	Range	Average	SD	Range	Average	SD
Weight(gm)	75-185	117.6	24.71	45-165	131.04	27.63
Length(cm)	6.8-12.3	9.35	1.07	6.9-11.9	9.5	0.98
Breadth(cm)	4.4-6.3	5.3	0.91	4.4-6.5	5.5	0.62
Thickness(cm)	2.9-5.6	3.75	0.65	2.5- 4.9	3.68	0.62
Length of cortex(cm)	0.4-1.2	0.77	0.21	0.4-1.2	0.78	0.25
Length of medulla(cm)	0.9-1.7	1.82	0.39	1.2-2.8	1.79	0.38
Number of pyramid	6-18	10	3	6-13	9	2
Number of minor calyx	2-10	6	2	3-9	6	2
Number of major calyx	1-5	3	1	1-5	3	1
Number of renal sinus	12-10	6	2	2-8	5	2

The number of pyramid of right kidney ranged from 6 to 18, average number of pyramid was found to be 10 ± 3 (Table 1). The number of minor calyx of right kidney ranged from 2 to 10, average number of minor calyx was found to be 6 ± 2 (Table 1). The number of major calyx of right kidney ranged from 1 to 5, average number of major calyx was found to be 3 ± 1 (Table 1). The number of renal sinus of right kidney ranged from 1 to 12, average number of renal sinus was found to be 6 ± 2 (Table 1). Among 50 right kidneys, 6% observed lobulation kidney, 2% observed in polycystic kidney and 92% revealed normal kidney (Table 2). We observed hilum of right kidney with an arrangement of renal vein, renal artery and renal pelvis before backwards in 66% kidney (Table 2). 14% observed in renal artery, renal vein and renal pelvis before backwards (Table 2). Among 50 left kidneys, weight ranged from 45 gm to 165gm and average weight was found to be 131.04 ± 27.63 gm (Table 1). The length of left kidney ranged from 6.9 cm to 11.3 cm, average length of the kidney was found to be 9.5 ± 0.98 cm (Table 1). The breadth of left kidney ranged from 4.4 cm to 6.5 cm, average breadth of the kidney was found to be 5.5 ± 0.62 cm (Table 1). The thickness of left kidney ranged from 2.5 cm to 4.9 cm, average thickness of the kidney was found to be 3.68 cm (Table 1). The length of cortex of left kidney ranged from 0.4 cm to 1.2 cm, average length of cortex of the kidney was found to be 0.78 ± 0.25 cm (Table 1). The length of medulla of left kidney ranged from 1.2 cm to 2.8 cm, average length of medulla of the kidney was found to be 1.79 ± 0.38 cm (Table 1). The number of pyramid of left kidney ranged from 6 to 13, average number of pyramid was found to be 9 ± 2 (Table 1). The number of minor calyx of left kidney ranged from 3 to 9, average number of pyramid was found to be 6 ± 2 (Table 1). The number of major calyx of left kidney ranged from 1 to 5, average number of pyramid was found to be 3 ± 1 (Table 1). The number of renal sinus of left kidney ranged from 2 to 8, average number of renal sinus was found to be 5 ± 2 (Table 1).

Table 2. Comparison of percentage variation including hilar arrangement in between right and left kidney

%	Right Kidney	Left Kidney
Bean shaped	92	92
Lobulation	6	8
Polycystic	2	Nil
Hilar arrangement(VAD)	66	70
Hilar arrangement (AVD)	34	28
Hilar arrangement (VADVA)	Nil	2
Horse shoe kidney		0.99

Table 3. Measurement of horse shoe kidney

	Right Kidney	Left Kidney	Isthmus
Weight(gm)		330	
Length(cm)	7.4	8.5	8.0
Breadth(cm)	5.6	4.9	3.7
Thickness(cm)	4.8	4.0	2.0
Length of cortex(cm)	0.7	0.9	0.6
Length of medulla(cm)	2.6	2.7	1.2
Number of pyramid		20	
Number of minor calyx		24	
Number of major calyx		8	
Number of renal sinus		19	

Among 50 right kidneys, 8% observed lobulation and 92% revealed normal kidney (Table 2). We observed hilum of right kidney with an arrangement of renal vein, renal artery and renal pelvis before backwards in 70% kidney (Table 2).

Table 4. Measurement of right kidney

S.No.	Weight (gm)	Length (cm)	Breadth (cm)	Thickness (cm)	Length Of Cortex (cm)	Length Of Medulla (cm)	No of Pyramid	No of Minor Calyx	No of Major Calyx	No of renal sinus	Hilar Arrangement (shape)
1	135	10.3	6.1	4.2	0.8	2.1	9	7	4	5	VAD(bean)
2	155	11.4	5.3	4.2	0.9	1.6	15	9	3	6	VAD(bean)
3	140	10.6	5	3.9	0.7	2	18	9	5	8	VAD(bean)
4	115	10.3	6.3	5	1.1	2.7	6	5	2	6	AVD(lobulated)
5	120	8.6	5.8	3	0.7	1.8	7	6	2	6	AVD(bean)
6	135	8.5	5.3	3.5	0.4	1	18	9	3	10	AVD(Polycystic)
7	145	9.7	3.8	3.1	0.6	2.3	8	6	2	9	VAD(bean)
8	112	7.9	5	3	0.7	1.6	9	5	2	6	VAD(lobulated)
9	95	10.2	5.4	3.1	0.6	2.2	12	9	3	7	AVD(bean)
10	185	9.7	5.9	3.6	1.1	2.4	7	7	2	9	AVD(bean)
11	100	12.3	4.7	4.1	0.8	1.8	15	8	2	12	AVD(bean)
12	125	10	5	4	0.7	1.7	18	5	1	10	VAD(bean)
13	145	9.8	5.6	3.7	0.9	2	6	7	3	8	VAD(bean)
14	108	8.7	3.9	3.2	0.8	1.8	9	9	2	9	VAD(bean)
15	95	9.2	5.1	4.2	0.6	1.6	12	6	2	7	AVD(bean)
16	100	9.1	6	4	1.2	1	9	4	4	6	AVD(bean)
17	95	9.1	5.3	3.9	1.1	1.6	6	9	5	4	VAD(bean)
18	145	10.3	5.2	4	0.9	2.1	8	7	2	5	VAD(bean)
19	120	8.5	5.5	4.8	0.7	1.6	13	6	3	7	AVD(bean)
20	95	8.1	5.4	5.6	0.8	1.8	15	10	2	9	AVD(bean)
21	75	9.1	4.4	3.9	0.6	2.2	10	6	4	8	VAD(bean)
22	125	6.8	5.2	2.9	0.7	1.3	9	4	1	10	AVD(bean)
23	113	10.1	5.6	3.8	0.8	1.6	6	6	2	6	VAD(lobulated)
24	85	8.7	5.2	3.6	0.4	2.4	12	9	2	6	VAD(bean)
25	108	8.2	5.1	4.2	0.6	2.2	15	7	3	7	VAD(bean)
26	185	9.7	6.2	3.6	0.7	1.6	9	6	2	4	VAD(bean)
27	145	8.6	5.3	3.2	1.1	1.7	12	8	4	1	VAD(bean)
28	130	7.9	5.6	4.3	0.4	2.1	7	9	4	6	AVD(bean)
29	125	12.3	4.9	3.1	0.8	1.6	8	7	3	5	VAD(bean)
30	105	10.2	5	3.7	0.6	1.4	10	5	2	4	VAD(bean)
31	115	8.6	0.3	3.9	0.7	1.8	8	8	4	6	VAD(bean)
32	145	8.5	5.3	5.2	0.9	1.7	9	5	3	3	VAD(bean)
33	100	9.7	5.4	5	1.1	2.3	6	9	2	6	AVD(bean)
34	95	9.2	5.2	4.2	0.7	2.2	13	7	4	4	VAD(bean)
35	125	10	6.2	3.9	0.8	1.7	9	2	2	1	VAD(bean)
36	75	7.2	5.1	3.1	0.6	1.6	7	4	3	3	VAD(bean)
37	113	8.6	5	3.7	1.2	1.9	8	8	4	7	VAD(bean)
38	145	9.8	4.9	4.8	0.9	2.4	12	9	5	8	AVD(bean)
39	135	9.6	5.6	3.9	0.7	2.2	13	6	3	6	VAD(bean)
40	125	9.9	6	3.1	0.6	1.6	8	3	2	3	VAD(bean)
41	75	8.3	5.2	3	0.9	1.2	10	4	2	3	VAD(bean)
42	95	8.7	5.4	2.9	0.8	1.8	9	5	3	5	VAD(bean)
43	105	9.5	6.2	3.4	1.1	0.9	12	3	2	4	VAD(bean)
44	115	10	6.5	3.7	0.7	1.6	7	2	1	2	VAD(bean)
45	113	9.9	5.7	3.2	0.6	1.9	13	4	2	4	VAD(bean)
46	85	8.9	5.2	2.9	0.4	2.4	10	3	2	5	VAD(bean)
47	108	9.2	6.1	3.9	0.7	2.1	9	6	4	7	AVD(bean)
48	95	9	6	3.1	0.5	1.9	12	5	3	4	VAD(bean)
49	135	9.6	5.9	3	0.8	1.4	15	4	2	3	VAD(bean)
50	120	9.4	5.9	3.4	1	1.6	8	3	2	4	VAD(bean)

Table 5. Measurement of left kidney

S.No	Weight (gm)	Length (cm)	Breadth (cm)	Thickness (cm)	Length of Cortex (cm)	Length of Medulla (cm)	No of Pyramid	No of Minor Calyx	No of Major Calyx	No of Renal Sinus	Hilar Arrangement (shape)
1	115	10.1	6.5	3.8	0.7	1.9	8	6	1	7	AVD(bean)
2	145	8.8	5.6	3.8	0.9	1.9	6	5	2	5	VAD(bean)
3	150	9.3	5.8	4.3	0.8	1.7	7	8	3	7	AVD(lobulated)
4	257	9.6	6	3.8	0.9	1.9	6	7	3	6	VAD(bean)
5	145	9.3	5.8	4.1	0.8	1.6	12	9	5	8	AVD(bean)
6	140	9.8	6.3	3.7	1.1	2.8	9	6	4	6	VADVA(bean)
7	137	9.6	5.6	3.2	1	2.5	10	7	2	5	VAD(bean)
8	145	9.8	6.5	4.3	0.7	1.8	8	6	2	8	VAD(bean)
9	155	10.2	5.4	3.6	0.6	1.2	12	8	3	7	AVD(lobulated)
10	125	9.1	5	2.9	1.2	1.9	6	3	2	6	VAD(bean)
11	120	10	4.9	3.5	0.7	1.3	6	4	2	6	VDA(bean)
12	135	10	5.6	3	0.6	1.7	7	6	4	5	VAD(bean)
13	105	8.8	6.2	3.8	0.5	1.8	8	5	3	6	VAD(bean)
14	115	9.3	5.3	4.2	0.2	1.9	12	6	2	8	VAD(bean)
15	150	8.8	5.5	2.5	0.5	1.7	7	4	2	6	VAD(bean)

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16	110	10	5.3	4.5	0.4	1.4	6	4	3	7	AVD(bean)
17	145	10.2	4.7	4.3	0.8	1.6	12	7	5	8	VAD(bean)
18	165	11.3	4.7	4.6	0.9	1.7	8	6	4	6	VAD(bean)
19	155	10.9	4.4	4.2	1.1	1.8	9	8	2	6	VAD(bean)
20	130	10.6	4.4	3.9	0.7	2.2	7	5	3	5	VAD(bean)
21	95	10.9	4.8	4	0.6	2.2	10	3	5	8	VAD(bean)
22	45	6.9	4.7	3.7	1.2	1.8	6	5	2	6	AVD(bean)
23	127	10.3	5.4	4.5	0.8	2.3	9	7	1	7	AVD(lobulated)
24	105	9.2	5.6	4.2	1	1.7	13	9	3	8	AVD(lobulated)
25	135	8.4	4.8	4.9	0.7	1.9	10	8	1	6	AVD(bean)
26	125	8.8	5.2	3.6	0.4	2.2	9	5	2	2	VAD(bean)
27	105	9.6	6.3	3.8	0.8	1.8	7	8	3	2	VAD(bean)
28	125	9.3	5.8	2.5	0.9	2.4	8	3	1	2	VAD(bean)
29	115	10.1	5.6	4.1	1.1	1.6	6	9	4	5	VAD(bean)
30	150	8.9	6.5	3.7	0.7	1.9	6	7	3	7	VAD(bean)
31	145	6.9	6.2	4.6	0.9	1.8	9	6	2	3	VAD(bean)
32	135	8.2	4.7	3.9	0.6	2.4	8	5	2	3	AVD(bean)
33	115	9.3	5.4	3.7	0.1	1.4	7	4	1	2	VAD(bean)
34	155	11.3	6.5	4.3	0.9	1.9	12	7	3	4	VAD(bean)
35	137	9.6	5.3	2.9	1.2	1.6	10	6	2	3	VAD(bean)
36	120	9.6	6.2	3.8	0.6	2.2	9	9	4	6	VAV(bean)
37	105	6.9	5.8	4.5	0.8	1.8	8	8	3	4	AVD(bean)
38	127	10	5	3.2	1.1	1.4	10	5	1	3	VAD(bean)
39	145	9	5.4	3.8	0.9	1.9	9	7	3	4	VAD(bean)
40	95	9.3	5.3	3	0.6	1.2	10	4	2	3	VAD(bean)
41	105	9.7	5.7	2.9	0.8	1.6	9	3	2	3	VAD(bean)
42	125	10.2	6	3.4	0.9	1.4	7	5	3	4	VAD(bean)
43	115	10	5.9	3.1	0.9	1.5	8	4	2	3	VAD(bean)
44	145	10.7	6.2	4.2	1.1	0.7	6	6	3	4	VAD(bean)
45	135	9.8	5.8	3.1	0.7	1.2	12	7	4	6	AVD(bean)
46	145	9.9	5.8	2.9	0.4	2.2	10	8	3	5	VAD(bean)
47	127	8.3	4.9	2.6	0.6	2	9	9	3	6	AVD(bean)
48	135	8.9	5	3	0.8	1.8	7	5	2	3	VAD(bean)
49	125	8.4	3.9	2.9	0.8	1.9	6	4	2	2	VAD(bean)
50	145	9.4	5.6	3	1	1.4	8	3	1	2	VAD(bean)

ABBREVIATION

1. cm.....centimeters
2. gm..... grams
3. A.....renal artery
4. SD.....Standard Deviation
5. V.....renal vein
6. D.....renal pelvis

28% observed in renal artery, renal vein and renal pelvis before backwards (Table 2). 2% observed in renal artery, renal vein, renal pelvis renal vein and renal artery before backwards (Table 2). We observed 1 out of 101 horse shoe kidney, right and left kidneys fused from their lower poles with parenchymal tissue called isthmus. The horse shoe kidney was supplied by 6 arteries, 3 renal veins and 2 extra renal pelvis. The weight of horse shoe kidney was found to be 330 gm (Table 3). The number of pyramid, minor calyx, major calyx and renal sinus of horse shoe kidney were found to be 20, 24, 8 and 19 respectively (Table 3). Length of right kidney was found 7.4 cm, with breadth 5.6 cm, and thickness 4.8 cm (Table 3). Length of cortex and medulla of right kidney were found 0.7 cm and 2.6 cm respectively (Table 3). Length of left kidney was found 8.5 cm, with breadth 4.9 cm, and thickness 4.0 cm (Table 3). Length of cortex and medulla of left kidney were found to be 0.9 cm and 2.7 cm respectively (Table 3). Length of isthmus was found 8.0 cm, with breadth 3.7 cm, and thickness 2.0 cm (Table 3). Length of cortex and medulla of right kidney were found 0.6 cm and 1.2 cm respectively (Table 3).

DISCUSSION

Macroscopic morphometrical variations of right and left kidneys were studied and explained their clinical significance. In present study, 92% both(right and left) kidneys were bean

shaped, 2% right polycystic kidney, embryological aspect polycystic kidney results from the failure of fusion between the secreting and collecting tubules. It had been proved convincing that such cyst formation takes place due to abnormal dilation of uriniferus tubules. They are of adult type (autosomal dominant) and childhood type (autosomal recessive) (Datta 2008) and 0.99% horse shoe kidney. 8% was lobulated kidney, which is more frequent in left kidney. The foetal kidneys are subdivided into lobules which disappear during infancy as nephron increases and grow. The lobulation observed in present study had no association with any other structural variations or defect. It might have revealed clinical significance. In our study, the average weight of right and left kidneys were 117.6 ± 24.71 gm and 131 ± 27.63 gm respectively. This is not coinciding with earlier studies that described the average weight of right and left kidneys to be 108.7 ± 22.6 gm and 111.8 ± 23.3 gm respectively (Rao *et al.*, 2013). Average length of right and left kidney was 9.35 ± 1.07 cm and 9.5 ± 0.98 cm respectively which is vary from data obtained by ultrasonography, length of right kidney in male and female were 11.40 ± 1.83 cm and 11.25 ± 3.11 cm respectively and length of left kidney in male and female were 11.63 ± 0.96 cm and 11.30 ± 3.56 (Hussein AA, *et al.*, 2010). Average breadth of right and left kidney was 5.3 ± 0.91 cm and 5.5 ± 0.62 cm respectively. Average thickness of right and left kidney was 3.57 ± 0.65 cm and 3.68 ± 0.62 cm respectively, which differ

from some author and the renal dimension may vary with population of geographical and races. However, this could indicate that our present study showed variation in weight and dimensions when compared with earlier findings. Kidney weight and dimension are considered as important indication for many clinical, congenital and immunological signs. Earlier studied said that aging leads to progressive hypotrophy in kidney, after middle age (Khatun *et al.*, 2009). Present study said that there is significant correlation between kidney shape, weight and dimension was observed in patient with chronic kidney disease. We found in present study, average length of cortex and medulla on coronal section of right and left kidney was $0.78 \pm 0.25\text{cm}$ and $1.79 \pm 0.38\text{cm}$ respectively. As much data is not available, in morphometric variation on coronal section. Data obtained in this study could be a good stand point for research of kidney transplantation and significant for clinioanatomical study of kidney lesions. In present study, we have found average number of right and left kidney pyramid, minor calyx, major calyx, and renal sinus were 10 ± 3 , 6 ± 2 , 3 ± 1 , 6 ± 2 and 9 ± 2 , 6 ± 2 , 3 ± 1 , 5 ± 2 respectively. It was found normal left hilar artery 71.1% and normal right hilar artery 10.8% (Perla 2012). Prehilar multiple branching of renal arteries was reported by 11.66% (Budhiraja *et al.*, 2010). In present study, 34% and 30% were found variation in hilar structures in right and left kidney respectively. Whereas 66% and 70% were found normal hilar structures in right and left kidney respectively. Hilar variation is normally caused by altered position of artery, vein and renal pelvis. This indicates a failure of complete regression of all primary vascular channels. The arteries may constrict renal pelvis or major calyx which results altered haemodynamics in renal physiology. Whatever, it doesn't increase the kidney susceptibility to disease. These variations should be known to surgeon during kidney transplantation because it may cause post operative bleeding. We found 0.99% horse shoe kidney with normal position including data of right and left kidneys and isthmus (Table 3). In 1 in 500 persons, the poles of the kidneys are fused; usually it is the inferior poles that fuse. About 7% of person with turner syndrome have horse shoe kidneys (Behrman *et al.*, 1996). Large U shaped kidney usually lies in hypogastrium anterior to the inferior lumbar vertebra. Normal ascent of the fused kidney is prevented because they are caught by the root of inferior mesenteric artery (Tijerina *et al.*, 2009). 20%- 60% of patient with horse shoe kidney have stones (Muttarak *et al.*, 2012). However, approximately one third of patient with horse shoe kidney are asymptomatic and horse shoe kidney is diagnosed as incidental finding. If urinary flow is impeded, signs and symptoms of obstruction and/ or infection may appear.

Williams tumors are 2 to 8 times more frequent in children with horse shoe kidney than in general population (Moore *et al.*, 1999). We studied that data, weight, dimension, length of cortex and medulla, number of pyramid, minor calyx, major calyx, and renal sinus, normal (bean shaped), lobulation, polycystic and horse shoe kidney.

CONCLUSION

We can conclude that shape, renal dimension, length variation of cortex and medulla, number of pyramid, minor calyx, major calyx and renal sinus and hilar arrangement could possess significant physiological and clinical values. With parameters, it is necessary to distinguish the pathological kidneys from normal sized healthy kidney. Determination of those studies should be fruitful for pathological, surgical and radiological interventions.

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