Original article

Morphometric study of renal arteries

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Abstract:

Kidney is the most important vital organ of the body. It is a compound tubular glandular structure which excrete final product of metabolic activity and excess water and ions. It is essential to study the anatomy of renal artery of human kidney in Bangladeshi people with special attention for any variation from standard as well as kidney surgeons for diagnosis and planes of treatment. This is an observational, descriptive type of study carried out in the Department of Anatomy of SSMC from January'2004 to December'2005. The study was performed on 49 pair of human kidney. All these samples were collected from autopsied in the morgue of the Department of Forensic Medicine of Dhaka Medical College and Sir Salimullah Medical College. The collected samples were divided into three age groups, group A (6-20 yrs), group B (21-35 yrs) and group C (37-65 yrs). The present study was done to observe the origin, length and breadth of both renal arteries. Morphological study was carried out by observational and metric method. There was no statistically significant difference found in the origin, length & breadth of the renal arteries in different age groups. The present study will reveal a morphometric baseline data of human renal arteries and compare the data with that of other countries.

Keywords: Human kidney, renal artery, different age group.

Introduction:

Any morphological changes of kidney cause severe diseases. A large number of people in Bangladesh are suffering from kidney diseases. About 6 to 8 million people are suffering from kidney diseases in which 10 to 15 thousands developed acute renal failure and 15 to 20 thousands developed end stage renal failure[1]. Morphometric analysis of renal vessels, used in several clinical and scientific studies which provide information about the condition of these vessels[2]. It seems to believe that there is no definitive study about origin, length and breadth of the renal artery in Bangladeshi people and any role of this for producing kidney diseases. New promising treatment of end stage renal disease is kidney transplantation. Success of kidney transplantation mostly depends on vascular anastomosis besides tissue typing[3]. Renal arterial stenosis or any other renal arterial abnormalities may lead to develop systemic disease and difficulty also may arise during renal surgical treatment. The study of anatomy of the renal artery of Bangladeshi people is an undebatable requirement for fruitful transplantation.

Materials & Methods :

This is an observational, descriptive type of study carried out on 49 pair of human kidneys of Bangladeshi people of different ages and were examined to observe the origin, length and breadth of the renal artery in different age groups. The specimen for the study was collected from unclaimed dead body that was under examination in the morgue of the Department of Forensic Medicine of Sir Salimullah Medical College (SSMC) and Dhaka Medical College (DMC), Dhaka. The specimens were collected from dead bodies as early as possible without any apparent signs of purification.

Method :

Morphological study was carried out by observational and metric method which was done by using measuring tape.

Grouping of the samples:

The collected samples were divided into three groups. They are group A includes 6-20 years, group B includes 21-35 years & group C includes 36- 69 years (Table-1).

Table-1: Age distribution of different study groups. (According to Dermady[4], 1973)

| Group	Age range (years)	No. of samples (n=49)
A	06-20	12
B	21-35	20
C	36-69	17

Variables of the study:

- To observe the origin of the renal artery .
- To measure the distance between the origin of renal artery from the origin of superior mesenteric artery
- To measure the length and breadth of the renal artery

Procedure for measurements of origin, length and breadth of the renal artery

After proper cleaning of the abdominal aorta the origin of the renal artery was noted in relation to superior mesenteric artery. The distance between the origin of renal artery from the origin of superior mesenteric artery was measured by using measuring tape. The length of the renal artery on both sides was measured from origin to its division by using measuring tape. The breadth of renal artery was also measured with the help of measuring tape at the level of their origin (Fig1 & Fig 2).
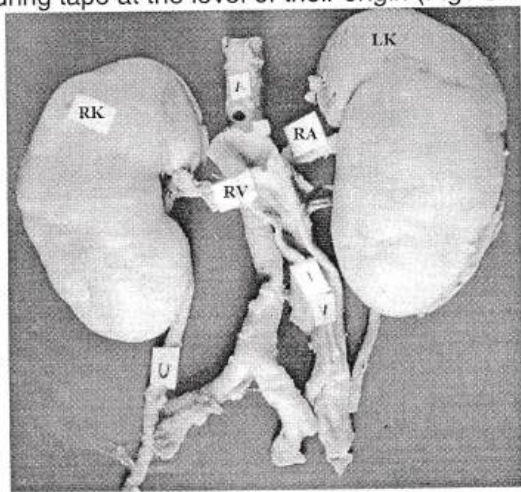
Fig 1: Renal artery (RA) origin from abdominal aorta (A).
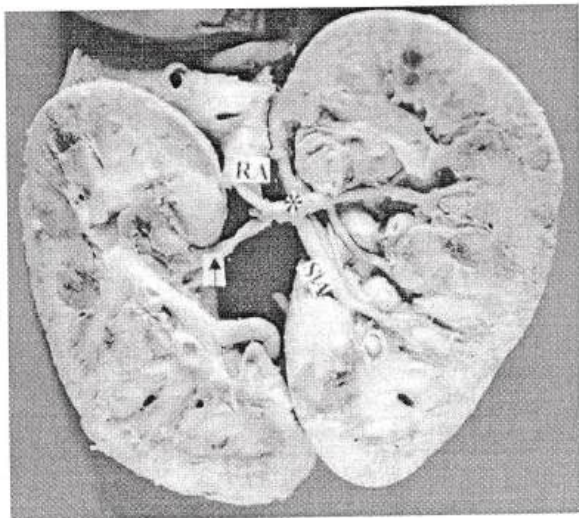
Fig 2: Coronal section of both kidneys showing renal artery (RA).

Results:

In the present study, renal artery of both kidneys in all group originated from lateral part of the abdominal aorta. Right renal artery was slightly higher origin in all group. Distance between origin of renal artery from the origin of the superior mesenteric artery were 0.93±0.34 cm in group A, 0.99±0.88 cm in group B & 0.98±0.31 cm in group C (Table 2 and Figure 3). In group A the mean length of the right & left renal artery was 3.45±0.56 cm and 2.97±0.59 cm and the range was 2.50 cm to 4.50 cm in right kidney and 2.0 cm to 3.9 cm in left kidney. In group B the mean length of the right & left renal artery was 3.45±0.56 cm and 3.13±0.74 cm and the range was 2.5 cm to 4.5 cm in right kidney and 2.00 cm to 4.5 cm in left kidney. In group C the mean length of the right & left renal artery was 3.97±0.87 cm and 3.48±0.91 cm and the range was 2.5 cm to 5.5 cm in right kidney and 2.0 cm to 5.0 cm in left kidney. From Table 3 and Figure 4, the mean length of the right renal artery was longer than the left in all groups. The differences in length were found to be maximum between group A vs group B, group A vs group C. Non significant difference in length of renal artery was found between group B vs group C. It was evident from Table 4 & Fig 5 that in the present study the mean breadth of the right & left renal artery were 5.33±0.65 mm and 5.37±0.71 mm in group A, 5.56±0.79 mm and 5.08±0.76 in group B and 5.57±0.74 mm and 5.53±0.79 mm in group C respectively.

Table-2: Distance between origin of renal artery from origin of superior mesenteric artery
P value obtained from unpaired student's 't' test (between groups).
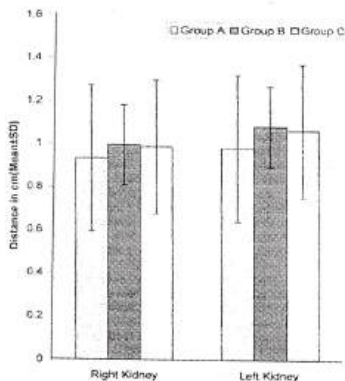
Distance between origin of renal artery from origin of superior mesenteric artery	Right Kidney		
	Mean±SD (cm)	Range (cm)	P value
Group A (n=12)	0.93±0.34	0.45-1.5	0.516 NS (A vs B)
Group B (n=20)	0.99±0.88	0.50-1.30	0.881 NS (B vs C)
Group C (n=17)	0.98±0.31	0.45-1.5	0.696 NS (A vs C)
	Left kidney		
Group A (n=12)	0.97±0.32	0.5-1.5	0.257 NS (A vs B)
Group B (n=20)	1.08±0.20	0.75-1.5	0.743 NS (B vs C)
Group C (n=17)	1.06±0.26	0.5-1.5	0.456 NS (A vs C)

Table-3: Length of the renal artery in different age groups
P value obtained from unpaired student's 't' test (between groups).
NS =Not significant

Length of the renal artery in different age groups	Right Kidney		
	Mean±SD (cm)	Range (cm)	P value
Group A (n=12)	3.45±0.56	2.50-4.50	0.648 [NS] (A vs B)
Group B (n=20)	3.45±0.56	2.50-4.50	0.078 [NS] (B vs C)
Group C (n=17)	3.97±0.87	2.50-5.50	0.079 [NS] (A vs C)
	Left kidney		
Group A (n=12)	2.97±0.59	2.00-3.90	0.543 [NS] (A vs B)
Group B (n=20)	3.13±0.74	2.00-4.50	0.196 [NS] (B vs C)
Group C (n=17)	3.48±0.91	2.00-5.00	0.099 [NS] (A vs C)

Table-4: Breadth of the renal artery in different age groups
P value obtained from unpaired student's 't' test (between groups).
NS =Not significant

Breadth of the renal artery in different age groups	Right Kidney		
	Mean±SD (cm)	Range (cm)	P value
Group A (n=12)	5.33±0.65	4.00-6.00	0.540 [NS] (A vs B)
Group B (n=20)	5.56±0.79	3.30-6.20	0.119 [NS] (B vs C)
Group C (n=17)	5.57±0.74	4.00-7.00	0.381 [NS] (A vs C)
	Left kidney		
Group A (n=12)	5.37±0.71	4.00-6.50	0.289 [NS] (A vs B)
Group B (n=20)	5.08±0.76	3.50-6.00	0.086 [NS] (B vs C)
Group C (n=17)	5.53±0.79	4.00-7.20	0.581 [NS] (A vs C)

Fig 3: Distance of renal artery from the origin of superior mesenteric artery
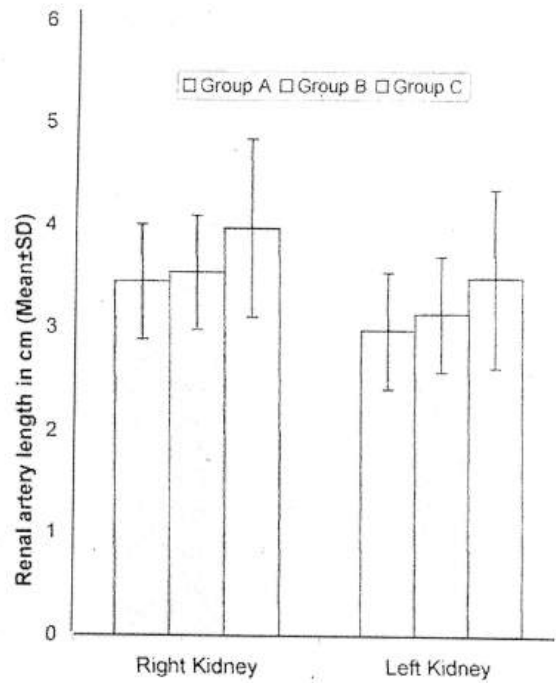
Fig 4: Length of the renal artery in different age groups
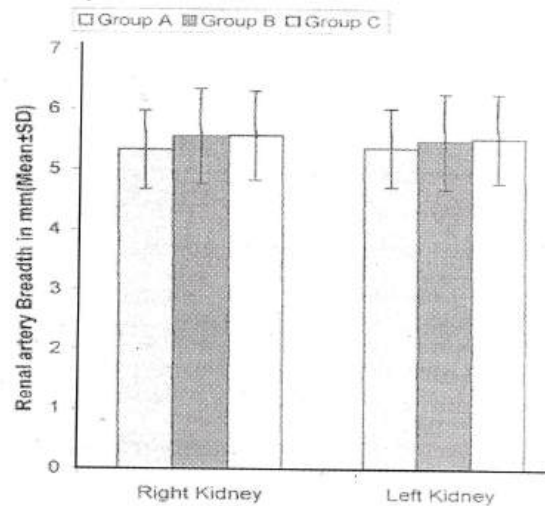
Fig 5: Breadth of the renal artery in different age groups

Discussion:

Morphological features of renal arteries of different age groups of postmortem human kidneys of Bangladeshi people were studied. Williams et al[5] described one renal artery to each kidney is present in about 70% of individual but vary in this level of origin and in their caliber. Basmajjan and Brodel[6] described that the renal

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artery of each kidney arise from abdominal aorta 1 cm below the superior mesenteric artery. In the present study renal artery of both kidneys in all group originated from lateral part of the abdominal aorta. In 1967 Mullic[7] found that the breadth of the renal artery is about 5mm which is similar to the present study. Williams's et al[5] al also described that the length of the renal artery is 4 cm which was also similar to the present study.

Conclusion :

From the findings of this study, it can be concluded that renal artery is originated from abdominal aorta. The distance between origin renal arteries and origin from superior mesenteric artery, length and breadth of renal artery were nearly similar with the above mentioned finding of kidneys in different ages. The observation and results of the present study are expected to standardize the anatomical study of renal artery in Bangladeshi people. Further studies using larger samples covering both sexes and wider age range are recommended.

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