

"Morphological Study Of The Renal Artery In 20 Human Cadavers: A Cross-Sectional Study."

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Abstract

Introduction: The renal artery, a direct lateral branch of the abdominal aorta that arises below the origin of the superior mesentery artery (SMA) between the lumbar vertebrae L1 and L2, supplies the kidney. Both the urinary and reproductive systems develop from intermediate mesoderm. Permanent renal arteries develop from lateral splanchnic branches that supply the pronephric, mesonephric, and metanephric kidneys and the gonads.

Materials and methods: The present study was carried out on 40 renal arteries (24 males and 16 females) in the Department of Anatomy, Krishna Mohan Medical College & Hospital, Mathura, Uttar Pradesh, India, by dissection method. The specimens for the study of renal arteries in 20 human cadavers taken from cadavers preserved in 10% formaldehyde solution.

Results: The mean length of the renal artery was (36.4 ± 11.77) mm and (27.4 ± 11.74) mm on the right and left sides, respectively. The average distance from the superior mesentery artery to the renal artery's origin was (16.1 ± 7.09) mm on the right and (14.9 ± 5.94) mm on the left. The mean diameter of the renal artery at its origin was (5.3 ± 1.25) mm and (5.5 ± 1.92) mm on the right and left sides, respectively.

Conclusion: These cadaveric dissections of renal arteries and their variations may help surgeons, radiologists, and clinicians in surgical procedures, renal transplantation, and treatment of patients.

Key words: Diameter, length, morphological study, renal arteries, renal transplantation.

INTRODUCTION

The human body contains many important systems that are helpful in the normal functioning of the body. Any anatomical variations in these systems may lead to abnormal functions of the body. Anatomists, surgeons, and medicine experts rely on these variations to perform surgical procedures and treat patients. The urinary system is one of the important systems that contain a pair of kidneys, ureters, and a urinary bladder. The renal artery, a direct lateral branch of the abdominal aorta that arises below the origin of the superior mesentery artery (SMA) between the lumbar vertebrae L1 and L2, supplies the kidney. Both the urinary and reproductive systems develop from intermediate mesoderm [1 & 2]. Both arteries cross the corresponding crus of the diaphragm at right angles to the abdominal aorta. The paired renal arteries take up 20% of cardiac output. The right renal artery is longer and higher than the left one because the abdominal aorta lies on the left side of the vertebral column [1]. The purpose of this research was to determine the length, diameter at its origin & distance from superior mesenteric artery to origin of renal artery & correlate the findings of the current study with the findings of the previous studies.

MATERIALS AND METHODS

The present study was a cross-sectional study done between January 2020 to January 2023 in the Department of Anatomy, Krishna Mohan Medical College & Hospital, Mathura, Uttar Pradesh, India. The specimens for the study of renal arteries in 20 human cadavers i.e. 40 renal arteries (24 males and 16 females) were obtained from

the cadavers preserved in 10% formaldehyde solution. Permission was taken from the institutional ethical committee. The anterior abdominal wall was opened by using the incisions and both the kidneys were exposed as per the guidelines given in the “Cunningham’s Manual of Practical Anatomy, 15th edition” [3]. All measurements were recorded by using digital Vernier caliper. The following measurements are made-

1. Length of renal artery in mm (fig. 1).
2. Distance from superior mesenteric artery (SMA) to its origin in mm (fig. 2).
3. Diameter of renal artery in mm (fig. 3).

Statistical analysis- The data was entered in Microsoft Excel. The mean and standard deviation of all parameters were analyzed using SPSS version 21.



Figure 1: Method of measuring length of renal artery.



Figure 2: Method of measuring the distance from SMA to its origin.



Figure 3: Showing methods of measuring diameter of renal artery at its origin.

RESULTS

Table 1, 2 & 3, depict the length, distance between superior mesenteric artery (SMA) to its origin & diameter of renal arteries.

Table 1: Showing results of length of renal artery (mm) on male and female on the both side.

Length of renal artery(mm)	Right	Range	Left	Range
	Mean \pm SD		Mean \pm SD	
Male	37.5 \pm 8.21	20.12-53.08	27.3 \pm 9.96	9.78-43.44
Female	35 \pm 14.33	12.5-51.89	27.7 \pm 14.67	7.77-51.66
Combined	36.4 \pm 11.77	12.5-5-3.08	27.4 \pm 11.74	7.77-51.66

Table 2: Showing results of distance from superior mesenteric artery to origin of renal artery of male and female on the both side.

Distance from SMA to origin of renal artery(mm)	Right	Range	Left	Range
	Mean \pm SD		Mean \pm SD	
Male	18.0 \pm 7.83	6.78-31.59	14.7 \pm 6.93	8.4-28.13
Female	13.3 \pm 4.57	9.02-21.24	15.1 \pm 5.45	7.61-20.94
Combined	16.1 \pm 7.09	6.78-31.59	14.9 \pm 5.94	7.61-28.13

Table 3: Showing results of diameter of renal artery at its origin (mm) in male and female on both the side.

Diameter of renal artery at its origin(mm)	Right	Range	Left	Range
	Mean \pm SD		Mean \pm SD	
Male	5.5 \pm 0.86	3.4-7.39	5.8 \pm 2.12	2.66-8.73
Female	5.1 \pm 1.43	2.17-6.92	5.1 \pm 1.43	3.24-7
Combined	5.3 \pm 1.25	2.17-7.39	5.5 \pm 1.92	2.66-8.73

DISCUSSION

In the present study, we observed from the 40 renal arteries that the mean length of the renal artery was (36.4 \pm 10.77) mm and (27.4 \pm 10.74) mm on the right and left sides, respectively. The mean length of the renal artery was greater in males than females on the right side, whereas on the left side, it was nearly equal in both male and female cadavers. The mean distance from the superior mesentery artery to the origin of the renal artery was (16.1 \pm 6.09) mm and (14.9 \pm 4.94) mm on the right and left sides, respectively. The mean distance from the superior mesenteric artery to its origin was greater in males than females on the right side, whereas on the left side it was greater in females than in males. The mean diameter of the renal artery at its origin is (5.3 \pm 1.15) mm and (5.5 \pm 1.83) mm on the right and left sides, respectively. The mean diameter of the renal artery was nearly similar in males and females on both sides.

Table 4: Comparative study of mean length of renal arteries on right and left sides.

S.N.	Authors and years of study	Right side (in mm)	Left side (in mm)
1.	Dhar Pushpa and Lal Kumud. (2005) [7]	31.05	25

2.	Palmeiri et al. (2011) [4]	36.8	39.6
3.	Bhadresh PV et al. (2013) [5]	38.04	27.04
4.	R Rajesh et al. (2013) [10]	57	41
5.	Ramulu MV and Prasanna LC. (2015) [8]	57	50
6.	Present study	36.4	27.4

In the present study, we observed that the length of renal arteries on the right side was higher than the study done by Dhar Pushpa and Lal Kumud. [7], whereas less than other studies Bhadresh PV et al [5], R. Rajesh et al. [10], Ramulu MV and Prasanna LC[8], but similar to Palmeiri et al [4]. The mean length of renal arteries on the left side in the present study was similar to the findings of Bhadresh PV et al. [5], but higher than that of Dhar Pushpa and Lal Kumud. [7] and less than the studies done by Palmeiri et al. [4], R. Rajesh et al. [10], Ramulu MV, and Prasanna LC [8].

Table 5: Comparative study of mean length of renal arteries in between males and females.

S.N.	Authors and years of study	Males (in mm)		Females (in mm)	
		Right	Left	Right	Left
1.	Saldarriaga B et al. (2008) [6]	34.6	28.68	35.98	28.20
2.	Present study	37.4	27.3	33.33	27.77

In the present study, we found that the mean length of the renal artery was higher on the right side and lower on the left side than Saldarriaga B et al. [6] in male cadavers, whereas the mean length of the renal arteries on the right and left sides was lower than the study findings by Saldarriaga B et al. [6].

Table 6: Comparative study of mean diameter of renal arteries at its origin on right and left sides.

S.N.	Authors and years of study	Right side (in mm)	Left side (in mm)
1.	Palmeiri et al. (2011) [4]	6.8	6.9
2.	Bhadresh PV et al. (2013) [5]	4.76	5.22
3.	Present study	5.3	5.5

In the current study, the mean diameter of renal arteries at their origin was higher than that reported by Bhadresh PV et al. [5] and lower than that reported by Palmeiri et al. [4] on the right and left sides, respectively.

Table 7: Comparative study of mean distance from SMA to origin of renal arteries on right & left sides.

S.N.	Authors and years of study	Right side (in mm)	Left side (in mm)
1.	Thompson SA et al. (1988) [8]	10.2	11.2
2.	Beregi JP et al. (2008) [9]	14.5	18

3.	Bhadresh PV et al. (2013) [5]	12.72	11.16
4.	Present study	16.1	14.9

In the current study, the mean distance from the superior mesenteric artery to the origin of renal arteries was higher than the studies conducted by Thompson SA et al. [8], Beregi JP et al. [9], and Bhadresh PV et al. [5] on the right side, but lower than Beregi JP et al. [9] and higher than Thompson SA et al. [8] and Bhadresh PV et al. [5].

Table 8: Comparative study of mean distance from SMA to origin of renal arteries in between males and females.

S.N.	Authors and years of study	Males (in mm)		Females (in mm)	
		Right	Left	Right	Left
1.	Saldarriaga B. et al. (2008) [6]	10.36	11.23	9.36	11.07
2.	Present study	18	14.7	13.3	15.1

In the current study, the mean distance from the superior mesenteric artery to the origin of the renal arteries on the right and left sides was higher than that reported by Saldarriaga B. et al. [6] in both males and females, respectively.

Table 9: Comparative study of mean diameter of renal artery at its origin in between males and females.

S.N.	Authors and years of study	Males (in mm)		Females (in mm)	
		Right	Left	Right	Left
1.	Saldarriaga B et al. (2008) [6]	4.8	4.97	4.57	4.71
2.	Palmeiri et al. (2011) [4]	7.11	7.17	6.14	6.53
3.	Present study	5.5	5.8	5.1	5.1

In the present study, the mean diameter of the renal artery at its origin on the right and left sides was higher than that reported by Saldarriaga B et al. [6] and Palmeiri et al. [4] in both males and females, respectively.

CONCLUSION

We concluded that the results of this study with respect to the morphological study of renal arteries are in correlation with the results of various studies mentioned in the literature. The morphological variations of renal arteries are important in the exploration and treatment of renal trauma, renal transplantation, renovascular hypertension, renal artery embolization, angioplasty, surgery for abdominal aortic aneurysms, and conservative renal surgery.

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