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Morphometry of Renal Arteries in Human Cadavers

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A B S T R A C T

Context: Morphometry of the renal artery is important as it shows great variations in individuals. The knowledge of variations in the renal arteries is very important due to increased cases of renal transplantation, interventional procedures, renal surgeries etc.

In having the above objectives in consideration, the present study has been undertaken.

Aims: To study the morphometry of renal arteries in human cadavers with respect to its origin and to compare right and left sided arteries in both male and female cadavers.

Methods and Material: The study includes 120 renal arteries from both male and female cadavers, from the Department of Anatomy KAHER'S J.N. Medical College, Belagavi. The renal arteries were traced and the origin was recorded and photographed. The statistical program used was IBM-SPSS 27, T-test for 'p' value (p=0.05 was considered statistical significance).

Results: The average distance from the superior mesenteric artery to the origin of renal artery was 13.38 ± 5.52 mm on the right and 12.99 ± 4.13mm left side of the total specimens. The average length from the superior mesenteric artery to the origin of renal artery was 13.66±4.53mm in male and 12.30±5.36mm in female. The renal artery arose from the lateral aspect of the abdominal aorta in 50%, from anterolateral aspect in 40% and posterolateral aspect in 10% of the total specimens.

Conclusions: The distance from the superior mesenteric artery to the origin of renal artery was more on the right side than left. The same length was more in male than female. The most common site of origin of renal artery was found to be from the lateral aspect of abdominal aorta.

Keywords: Kidney, Renal artery, Morphometry.

1. Introduction

Anatomical variations are natural differences in the structure of human bodies that occur among individuals. These variations are often harmless and considered part of normal biological diversity. A pair of renal arteries arise from abdominal part of aorta and supply the kidneys.[1] Right renal artery is generally higher and longer than left renal artery.[2] A thorough understanding of the arterial difference is critical due to considerable anatomical variation in the vascular system of the kidneys - most notably in the renal arteries.[3] Between the sixth and ninth weeks of development, the kidneys ascend from the pelvic region to their final position in the retroperitoneal space. During this migration, they continuously receive blood supply from the nearest available arteries. Initially, these vessels arise from the common iliac arteries, but as the kidneys move upward, they are gradually supplied by new branches emerging from the distal abdominal aorta. By the ninth week, the kidneys reach the level of the adrenal glands and become fixed in place. At this stage, they are nourished by the most superior branches of the abdominal aorta, which later develop into the permanent renal arteries. Typically, the right renal artery is longer and positioned slightly higher than the left.[4,5&6.]

This information is crucial in radiological imaging techniques such as CT scans and angiography for accurately diagnosing renal conditions. It also plays a vital role in interventional radiology procedures like renal artery stenting and angioplasty, where a clear understanding of the renal artery's size, pathway, and branching pattern is essential for safe and effective treatment. Furthermore, this knowledge is highly valuable to anatomists, anesthesiologists, and urologists, supporting their research and clinical expertise.

2. Objectives

To record the morphometry of renal artery with respect to its distance from superior mesenteric artery to its origin, the site of origin and to compare the same with right and left sides of male and female cadavers.

3. Materials and methods

The study was conducted on 120 specimens of renal arteries of human cadavers well preserved in formalin solution from the Department of Anatomy KAHER'S J.N. Medical College, Belagavi.
The renal arteries were traced and required parameters were recorded and photographed.
The dissection was according to standard Cunningham's manual[7] followed by which the distance from superior mesenteric artery to renal artery were recorded using digital Vernier caliper & the site of origin of renal artery were photographed.
The measurements were taken 3 times and the mean of 3 was taken as the value.

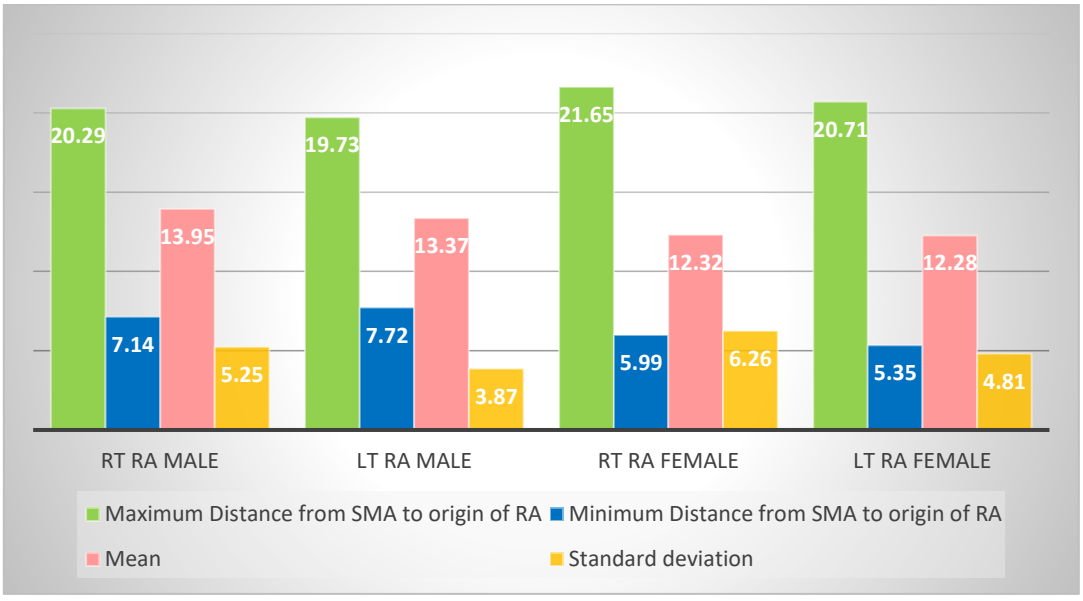
4. Results

A. Distance from superior mesenteric artery to renal artery in male and female

The maximum distance from superior mesenteric artery to the origin of renal artery was 20.92mm and 21.65mm, the minimum distance was 7.14mm and 5.99mm with a mean and standard deviation of 13.95±5.25 and 12.32±6.26 in male and female respectively on the right side. The maximum distance from superior mesenteric artery to the origin of renal artery was 19.73mm and 20.71mm, the minimum distance was 7.72mm and 5.35mm with a mean and standard deviation of 13.37±3.87 and 12.28±4.81 in male and female respectively on the left side. (Table no.1 & Graph no.1)

Distance from SMA to origin of RA	Male (n=78)		Female (n=42)	
	Rt. side (in millimeter)	Lt. side (in millimeter)	Rt. side (in millimeter)	Lt. side (in millimeter)
Maximum obtained value	20.92	19.73	21.65	20.71
Minimum obtained value	7.14	7.72	5.99	5.35
Mean	13.95	13.37	12.32	12.28
Standard deviation	5.25	3.87	6.26	4.81

Table no. 1 Comparative analysis of the distance from superior mesenteric artery to renal artery in all 120 specimens on right and left sides.



Graph no. 1 Distance from superior mesenteric artery to renal artery in all 120 specimens

B. Distance from superior mesenteric artery to renal artery in all 120 specimens

The mean distance from superior mesenteric artery to origin of renal artery was 13.66 ± 4.53mm in male and 12.30 ± 5.36mm in female. (Table no. 2)

C. Distance from superior mesenteric artery to renal artery on right and left side in all 120 specimens

The mean distance from superior mesenteric artery to origin of renal artery was 13.38 ± 5.52mm on right side and 12.99 ± 4.13mm on left side. (Table no. 2)

	Right side	**Left side**	**Male**	**Female**
	Mean±SD	**Mean±SD**	**Mean±SD**	**Mean±SD**
Distance from SMA to origin of renal artery	**13.38 ± 5.52**	**12.99 ± 4.13**	**13.66 ± 4.53**	**12.30 ± 5.36**

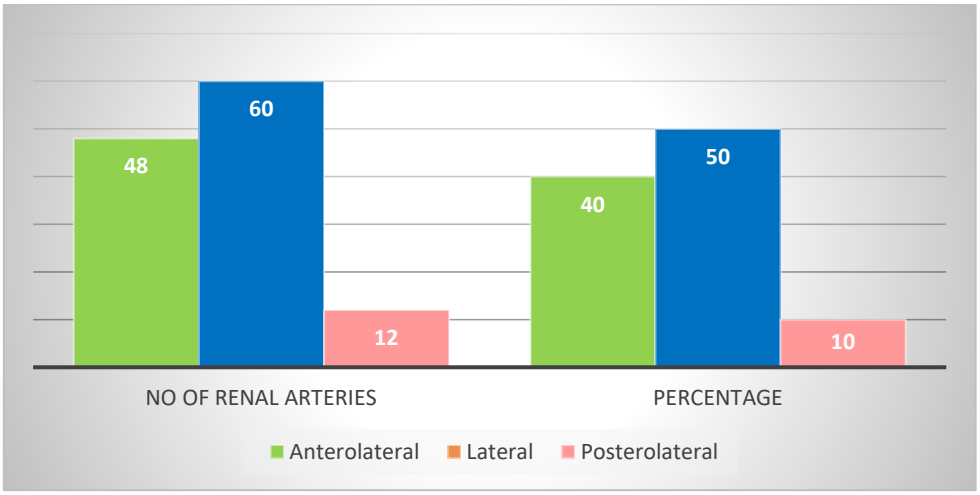
Table no. 2 Distance from SMA to origin of renal artery in male and female and on right and left side of all 120 specimens.

D. Site of origin of renal artery

In the present study out of 120 renal arteries, 60 arteries (50%) arose from the lateral aspect, 48 arteries (40%) arose from anterolateral aspect, & 12 arteries (10%) originated from posterolateral side of abdominal aorta. (Table no. 3 & Graph no.2)

Site of origin	**No of renal artery (n=120)**	**Percentage (%)**
Anterolateral aspect	48	40
Lateral aspect	60	50
Posterolateral aspect	12	10

Table no. 3 Site of origin of renal artery



Graph no.2 Site of origin of renal artery

Overall, the distance from superior mesenteric artery to renal artery was more on the right side compared to left side and it was more in male than female. The most common site of origin was lateral aspect of abdominal aorta.

5. Discussion

Distance from superior mesenteric artery to origin of RA from AA on Rt. & Lt. sides

Yadav HN et al. observed that the Avg. distance between the SMA & the RA's origin was 16.1 ± 7.09 mm on the Rt. & 14.9 ± 5.94 mm on the Lt.[8] Vaghela BP et al. reported that the distance between the RA origin & the SMA origin along the AA was 12.72 ± 3.04 mm on the Rt. side & 11.16 ± 2.42 mm on the Lt.[9] Saldarriaga et al. reported mean distances from the SMA to RA of 10.2 ± 6.0 cm on the Rt. side & 11.2 ± 5.7 mm on Lt.[10] Eri Yokota et al observed that the Avg. distance from SMA to RA was 15.6mm & 24.1mm on Rt. & Lt. side respectively.[11] In current research, we observed that the Avg. distance from SMA to origin of the RA was 13.38±5.5mm on Rt. side & 12.99±4.1mm on the Lt. side. The distance was greater on the Rt. side than Lt. which matches in all the other studies except in the study of Eri Yokota et al. where the distance was greater on the Lt. side.

Sr.no	Authors	Year	Rt side (in millimeter)	Lt side (in millimeter)
1.	Yadav HN et al.	2022	16.1±7.09	14.9±5.94
2.	Vaghela BP et al.	2013	12.72±3.04	11.16±2.42
3.	Saldarriaga et al.	2008	10.2±6.0	11.2±5.7
4.	Eri Yokota et al.	2005	15.6	24.1
5.	**Present study**	**2025**	**13.38±5.5**	**12.99±4.1**

Table no. 4

Comparative analysis of the mean distance from the SMA to origin of RA on Rt. & Lt. sides with other authors.

Plane of origin

Ramulu MV et al. noted that of 50 specimens of renal arteries 46 arteries (92%) originated from lateral side of abdominal aorta, 3 (6%) from its anterolateral aspect, & 1 (2%) from its posterolateral aspect.[12] In the present study we examined 120 renal arteries & reported that 60 arteries (50%) arose from the lateral aspect, 48 arteries (40%) arose from anterolateral aspect, & 12 arteries (10%) originated from posterolateral side of abdominal aorta. (Table no.5)

Sr.no	Authors	Year	Site of origin		
			Lateral aspect (%)	Anterolateral aspect (%)	Posterolateral aspect (%)
1.	Ramulu MV et al.	2015	92	06	2
2.	**Present study**	**2025**	**50**	**40**	**10**

Table no. 5 Comparative analysis of site of origin of renal artery with another author.

6. Conclusion

The distance from superior mesenteric artery to renal artery was more on the right side compared to left side and it was more in male than female. The most common site of origin was lateral aspect of abdominal aorta.

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