



## **Anatomical variations of renal arteries in 20 human cadavers & its clinical correlation**

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### **ABSTRACT**

*To observe and record the variations of the renal artery pattern in human cadavers, and to further compare & correlate the present findings with the previous studies. Blood supply of renal gland is mainly done by renal artery. Renal artery are a pair of lateral branches from abdominal aorta & arise inferior to the origin of superior mesentery artery (SMA) between the lumbar vertebra L<sub>1</sub> & L<sub>2</sub>. Permanent renal arteries develop from lateral splanchnic branches which supply the pronephric, mesonephric and meta-nephric kidneys and the gonads. 20 cadavers (24 males and 16 females) were dissected in the Department of Anatomy, Krishna Mohan Medical College & Hospital, Mathura, UP, India & Faculty of Medicine and Health Sciences SGT University, Gurugram, Haryana and 40 renal arteries studied. We observed from the 40 renal arteries i.e. 20 cadavers that 67.5% of the kidneys were single renal arteries, 25% had double and 7.5% had triple renal arteries which are originating from lateral branch of the abdominal aorta. These cadaveric dissections of renal arteries & their variations may help the surgeons, clinicians, in surgical procedures, renal transplantation, and treatment of the patients.*

**Key words:** *Kidney, Renal transplantation, single, double & triple renal arteries.*

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### **INTRODUCTION**

Blood supply of renal gland is mainly done by renal artery. Renal artery are a pair of lateral branches from abdominal aorta & arise inferior to the origin of superior mesentery artery (SMA) between the lumbar vertebra L<sub>1</sub> & L<sub>2</sub>.<sup>1&2</sup> Both urinary and reproductive systems develop from intermediate mesoderm.<sup>1&3</sup> Permanent renal arteries develop from lateral splanchnic branches which supply the pronephric, mesonephric and metanephric kidneys and the gonads. Renal artery plays an important role in selecting the appropriate kidney for laparoscopic procedures.<sup>2</sup> Primary renal artery originating from some other major artery in that region like superior mesenteric artery, coeliac trunk<sup>4</sup> common or external iliac artery and gonadal artery is extremely uncommon.<sup>5</sup> Both arteries cross the respective crus of diaphragm at right angle to the abdominal aorta. Paired renal arteries take 20% of cardiac output. Right renal artery is longer & higher than the left artery as abdominal aorta lies on the left side of the midline.<sup>1&3</sup> Variation in the branching pattern of the renal arteries are common in human kidneys. These variations play an important role in invasive interventions like renal transplantation, radiological procedures and renal operation. To observe and record the variations of the renal artery pattern in human cadavers, and to further compare & correlate the present findings with the previous studies.

### **MATERIAL AND METHODS**

20 cadavers (24 males and 16 females) were dissected in the Department of Anatomy, Krishna Mohan Medical College & Hospital, Mathura, UP, India & Faculty of Medicine and Health Sciences SGT University, Gurugram, Haryana and 40 renal arteries studied. The human cadavers preserved in 10% formaldehyde solution were dissected as part of the routine undergraduate curriculum during teaching of abdomen region. Permission was taken from the institutional ethical committee. The anterior abdominal wall was opened and both the kidneys along with their renal arteries were exposed & noted as per the guidelines given in the standard practical dissection instruction books

## RESULTS

We observed from the 40 renal arteries (20 cadavers) that 27 out of 40 (67.5%) of the kidneys were single renal arteries, 10 out of 40 (25%) had double and 3 out of 40 (7.5%) had triple renal arteries which are originating from abdominal aorta (showing on table 1). The total single, double & triple renal artery on **right side** was 6 out of 12 (50%), 4 out of 12 (33.33%) & 2 out of 12 (16.67%) and 6 out of 8 (75%), 2 out of 8 (25%) & 0 in males and females respectively (showing on table 2). The total single, double & triple renal artery on **left side** was 9 out of 12 (75%), 2 out of 12 (16.67%) & 1 out of 12 (8.33%) and 6 out of 8 (75%), 2 out of 8 (25%) & 0 in males and females respectively (showing on table 2). All the parameters of renal arteries also represented in graph no. 1. Figure 1 showing two renal arteries on both right & left side and figure 2 showing one renal artery one on the left side & three on the right side.

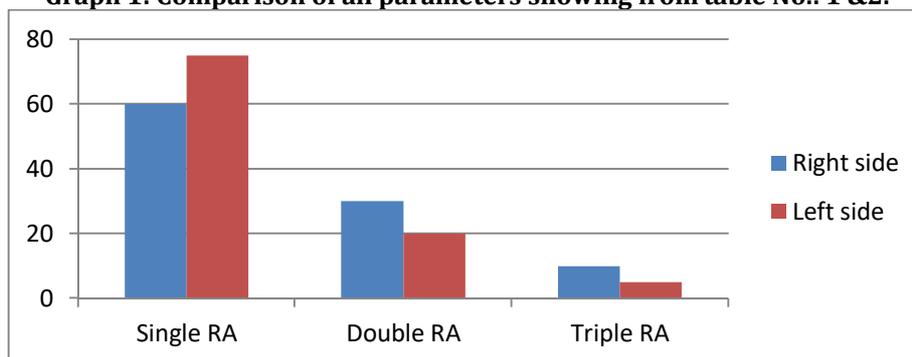
**Table 1:** Results showing the total different values of single double and triple renal arteries.

Total number of renal arteries	Total number of specimens	Percentage
Single (Normal)	27	67.5%
Double	10	25%
Triple	3	7.5%

**Table 2:** Results showing the values of single, double and triple renal arteries on both sides.

Total number of renal arteries	On the right side (%)	On the left side (%)
Single (Normal)	12 (60%)	15 (75%)
Double	6 (30%)	4 (20%)
Triple	2 (10%)	1 (5%)

**Graph 1: Comparison of all parameters showing from table No.: 1 & 2.**



**Figure 1:** Photograph showing two renal arteries on both right & left side.



**Figure 2: Photograph showing renal artery one on the left side & three on the right side.**

## DISCUSSION

The study of the variations in the renal arteries is clinically important for surgeons and radiologists. Multiple renal arteries as the name suggest is the presence of more than one renal artery supplying a particular renal gland. The accessory artery on the other hand arise directly from the abdominal aorta to supply a renal segment. Table 3 and 4 depicts the comparison of data attained in previous studies with that of the current study.

**Table 3. Comparison related to the number of renal arteries that enter the kidney**

Authors and years of study	Single renal artery	Double renal arteries	Triple renal arteries
Per Odman [7]	75.9%	18.6%	5.4%
Sampaio FJB & Passos MARF. [8]	53.3%	7.9%	1.9%
K.Khamanarong [9]	82%	17%	1%
Bordei P et al. [10]	78%	11%	11%
Cicekcibasi [11]	75%	21.6%	3.3%
Budhiraja V et al. [12]	-	22.6%	11.8%
Ankolekar V [13]	73.33%	23.33%	3.33%
<b>Present study</b>	<b>67.5%</b>	<b>25%</b>	<b>7.5%</b>

**Table 4. Compares studies pertaining to number of renal arteries on each side**

Authors and years of study	Single renal artery		Double renal arteries		Triple renal arteries	
	Right side	Left side	Right side	Left side	Right side	Left side
Koziolec.T [14]	86.4%	69%	10.9%	25.5%	2.7%	5.5%
Satyapal KS et al. [15]	-	-	18.6%	4.5%	27.6%	4.4%
Janschek ECS et al. [16]	-	-	18%	2.2%	15%	4%
Ugur Ozkan [17]	83%	86%	15%	12%	1%	0.7%
Ankolekar V [13]	75%	71.4%	25%	21.43%	-	7.14%
<b>Present study</b>	<b>60%</b>	<b>75%</b>	<b>30%</b>	<b>20%</b>	<b>10%</b>	<b>5%</b>

## CONCLUSION

We concluded that the results of this study with respect to the variations of renal arteries are in correlation with the results of various studies mentioned in the literature. These cadaveric dissections of renal arteries & their variations may help the surgeons, clinicians, in surgical procedures, renal transplantation, and treatment of the patients.

## CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest. The research received no specific grant from any funding agency in the public, community, or non-for profit sectors.

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