



## Essentials of Renal Vascular Anatomy- A Cadaveric Study

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### KEYWORDS

Accessory renal artery, renal artery, aberrant artery, hilar and prehilary artery

### ABSTRACT:

Accurate knowledge of the vascular pattern of kidneys is a prerequisite for performing surgeries like partial nephrectomy and renal transplantation. Renal arteries are paired branches from the abdominal aorta and happens to be most diversified in its pattern. Forty-eight embalmed cadaveric kidneys, 24 (right side) and 24 (left side) obtained during academic dissection. We observed (a) single renal artery in 60.3% of kidneys, double renal artery in 35.7%, triple and quadruple renal artery in 2% cases, (b) hilar branching pattern 35.5% and prehilary branching pattern in 64.5%, (c) unilateral presence of aberrant artery in 12.5% and bilateral presence of aberrant artery in 2.1%, (d) unilateral accessory renal artery in 20.8% and bilateral accessory renal artery in 2.1% cases, (e) presence of superior polar artery in 10.4% and inferior polar artery in 4.2% cases, (f) level of origin of renal artery at same level in 83.3% cases and right side origin higher than left in 16.7% cases. Insight into detailed vascular pattern may help in preventing in damage to hilar structures & prevents renal necrosis during surgical exploration.

### Introduction

Renal arteries are end arteries which supplies segments within the kidney & their variations are also common [1]. Multiple renal, aberrant & accessory renal arteries are some of the most commonly found variations. Accessory has got incidence of 30% in individuals [2]. These variations increase their risk of getting injured during surgical interventions & may jeopardize blood supply & may lead to necrosis. Awareness of the subject is necessary while advancing for renal transplantation, urological operations & radiological procedures [3].

### Materials and Methodology

#### Study design and study area

An observational study was conducted on twenty four human cadavers with forty eight kidneys dissected in the Department of Anatomy, Faculty of Medicine and Health Sciences, SGT University, Gurugram, Haryana. The work was carried during the routine abdominal dissection, the abdominal cavity was opened up and all

the viscera were gradually taken out and were preserved in formalin for teaching purpose. Both the kidneys were also carried out along with abdominal aorta and its lateral branches were explored to study the variations in the morphological pattern of renal arteries. Photographs were taken and frequency of variations were calculated.

### Results

#### Number of renal artery

Single renal artery observed in 29 cases (60.3%) with higher percentage on right side 16 cases (33.3%) and 13 cases (27%) on left side. Double renal artery observed in total 17 cases (35.7) with almost equal occurrence on right side 8 cases (17%) and on left side 9 cases (18.7%). Triple renal artery and quadruple renal artery observed in 1 case (2%) on left side only as shown in figure 1 and table 1.

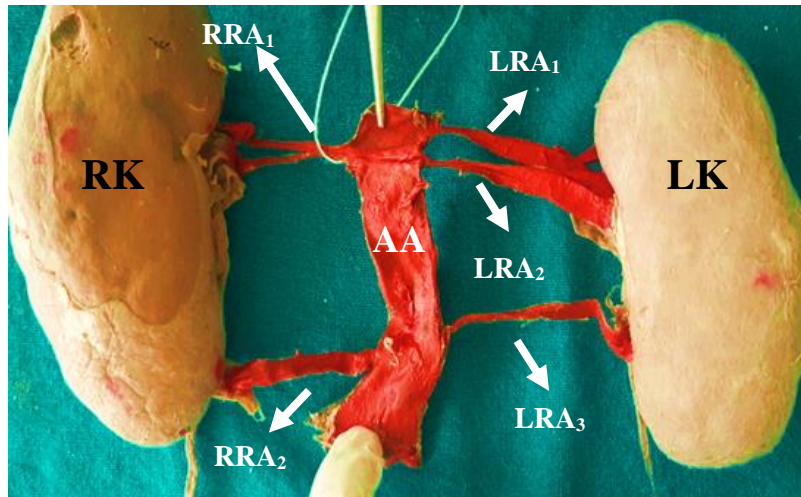


Figure 1- shows presence of double renal artery on right side and triple on left side with AA- Abdominal Aorta, RK- Right Kidney, LK- Left Kidney, RRA<sub>1</sub>- Right Renal Artery<sub>1</sub>, RRA<sub>2</sub>- Right Renal Artery 2, LRA<sub>1</sub>- Left Renal Artery 1, LRA<sub>2</sub>- Left Renal Artery 2 and LRA<sub>3</sub>- Left Renal Artery 3.

No. of Renal Artery	Right Side	Left Side	Total Kidneys
single	16(33.3%)	13(27%)	29 (60.3%)
double	8(17%)	9(18.7%)	17 (35.7%)
triple	0	1(2%)	1 (2%)
four	0	1(2%)	1 (2%)
	24	24	48 (100%)

**Table 1:** Distribution of different pattern of renal artery

**Hilar and prehilar branching pattern of renal artery**

Hilar branching pattern was recorded in 17 cases (35.5%), out of which 9 cases (18.7%) were of right side and 8 cases (16.8%) were of left side. Prehilar branching

pattern was observed in total 31 cases (64.5%) with 15 cases (31.2%) of right side and 16 cases (33.3%) on left side as shown in figure and table 2.

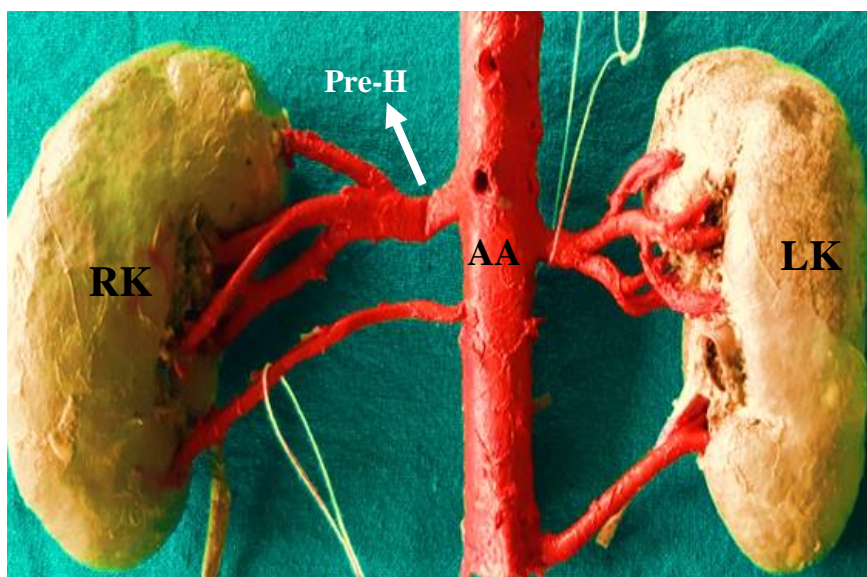
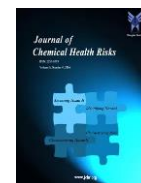


Figure 2- shows pre-hilar (Pre-H) branching pattern of right renal artery with AA- Abdominal Aorta, RK- Right Kidney and LK- Left Kidney.



Side	Hilar	Pre-hilar
Right	9(18.7%)	15(31.2%)
Left	8(16.8%)	16(33.3%)
Total	17 (35.5%)	31 (64.5%)

**Table 2:** Hilar and Pre-hilar division of renal artery

**Presence of aberrant renal artery**

Total 8 cases (14.6%) showed the presence of aberrant renal artery, out of these 6 cases (12.5%) were unilateral

and one (2.1%) was bilateral as shown in figure and table 3

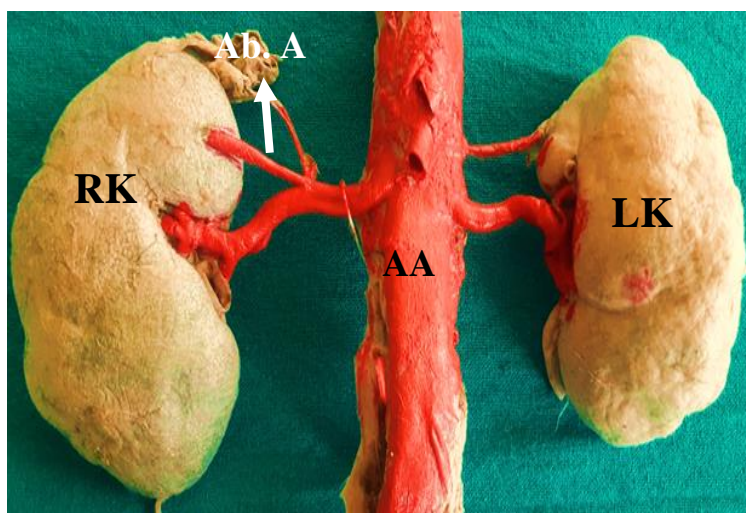


Figure 3 – shows presence of right side aberrant artery (Ab.A) arising from main renal artery with AA- Abdominal Aorta, RK- Right Kidney and LK- Left Kidney

Pattern	Kidneys	%
Unilateral	6 (6)	12.5%
Bilateral	1(2)	2.1%
Total	8	14.6%

**Table 3:** Distribution of aberrant artery

**Presence of accessory renal artery**

The presence of accessory renal artery was found in total 12 cases (22.9%). Out of these 10 cases (20.8%) were

unilateral accessory artery and one case (2.1%) were of bilateral accessory renal artery as shown in figure and table 4.



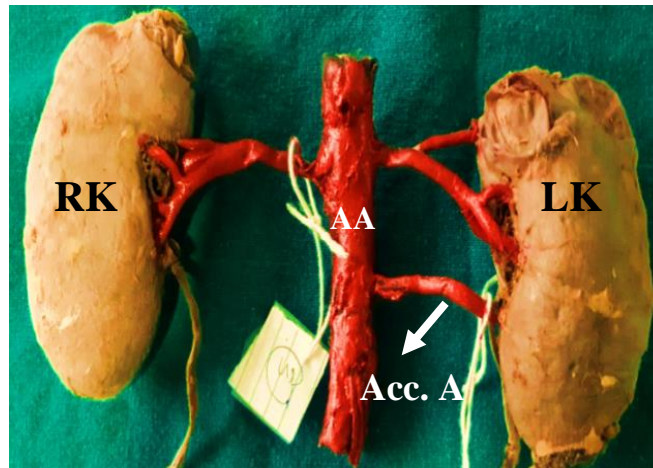


Figure 4 – Left side accessory (Acc. A) artery stems from abdominal aorta entering into hilum with AA- Abdominal Aorta, RK- Right Kidney and LK- Left Kidney.

Pattern	Kidneys	%
Unilateral	10 (10)	20.8%
Bilateral	1(2)	2.1%
Total	12	22.9%

**Table 4:** Accessory renal artery distribution

**Presence of Polar artery**

In our study, we found superior polar artery in 5 kidneys (10.4%) out of which 4 were seen in right side and 1 in

left side whereas inferior polar artery were observed in 4.2% of cases as shown in figure and table 5.

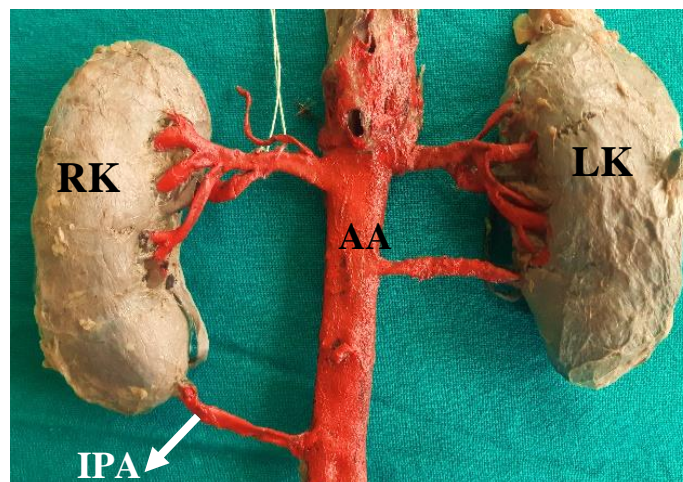


Figure 5- shows Inferior Polar Artery (IPA) entering into lower pole of right kidney (RK) branch of Abdominal Aorta (AA).

Side	Superior Polar Artery	Inferior Polar Artery
Right	4	2
Left	1	0
Total	5 (10.4%)	2 (4.2%)

**Table 5:** Occurrence of superior and inferior polar artery

**Level of origin of main renal artery**

Out of total cases, 83.3% of kidneys were having same level of origin of main renal arteries on both the sides



whereas in 16.7% of cases had higher level of origin of right renal artery than left renal artery as shown in figure and table 6.

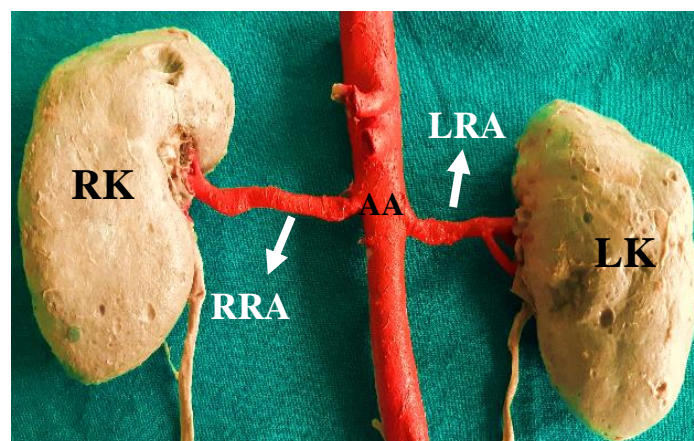


Figure 6: represents Right Renal Artery (RRA) higher than Left Renal Artery (LRA) supplying Right kidney (RK) and Left Kidney (LK) respectively, stems through Abdominal Aorta (AA).

Level Of Origin	%
Same Level	83.30%
Right Higher Than Left	16.70%

**Table 6:** Level of origin of main renal arteries.

### Discussion

Lateral mesonephric arteries arise from the dorsal aorta and form the renal artery. Failure of regression of middle group branches may result in the persistence of more than one renal artery supplying the kidney [4].

In our study, we found a higher incidence of the single renal artery (60.3%), followed by double renal artery (35.7%), then triple & quadruple artery (2%). A previous study also reported a greater incidence of the single renal artery (73.79%), followed by double renal artery (25.72%), then triple artery (0.49%) [5]. The incidence of the double renal artery was more common than the triple renal artery [6]. The present study also complies with similar findings. Multiple renal arteries may predispose to renal hypertension. It is easier to transplant a kidney with a single artery than with multiple arteries [7].

The pre hilar branching pattern was found in 31 cases (64.5%), with 15 cases on the right side & 16 cases on the left side, hilar pattern was observed in 17 cases (35.5%), suggesting the pre-hilar pattern was more common than hilar, & also we noted equal frequency on both sides in our study. However, a higher incidence of the pre-hilar pattern was also reported by previous studies [8, 9]. Very high incidence of the pre-hilar pattern was noted in 88.46% of cases. [10]. Equal incidence of pre-hilar pattern in 16.66% on both sides, similar to the present study [11]. A higher frequency of

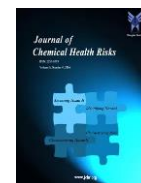
incidence on the left side pre hilar pattern than right side is different from our study [12].

In the present study, the aberrant renal artery accounts for 14.6% of cases, with 5 cases (10.4%) of superior polar & 2 cases (4.2%) of the inferior polar artery. Comparable results with superior polar in 10.7% were reported by a previous study [13]. Lower incidence was also reported with 6.8% & 9.25% cases [14, 1]

Equal incidence of 10% & 12.5% each of superior & inferior polar was also noted [15, 16]. The inferior polar artery may exert pressure over ureters, as they run anterior to ureters & may result in ureteric obstruction & hydronephrosis [17]. In our study, we observed a higher incidence of the unilateral accessory renal artery in 20% of cases & bilateral in 2.1% of cases. A previous study also reported unilateral accessory renal artery in 15% cases & bilateral in 5% cases close to our findings [18]. We also noted the same level of origin of both renal arteries in 83.30% of cases & also in 16.70% of cases right sided renal artery level was higher than the left side. Previous authors also reported similar results [12, 7]. Superior polar artery, pre-hilar pattern, right side renal artery level higher than left can be attributed to regional differences.

### Conclusion

Study of this type may provide us relevant information about type of patterns more prevalent in this population,



may improve the outcomes of various surgical procedures done on kidney & for better interpretation of renal angiograms.

**Conflict of Interest:** nil

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