

## POSTERIOR DIVISION OF LEFT RENAL ARTERY IS DIRECT BRANCH OF ABDOMINAL AORTA AND EARLY RAMIFICATION OF RENAL ARTERIES ON BOTH SIDES: A CASE REPORT

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### ABSTRACT

Knowledge of the vascular anatomy of the kidney is important not only for Anatomist but also to the surgeons to avoid surgical accidental injuries during partial nephrectomy, renal transplantation, interventional radiological procedures, laparoscopic renal surgeries and donor nephrectomies, urological and renal vascular operations more safely and efficiently. During the routine dissection in the department of Anatomy, Khaja Bandanawaz Institute of Medical Sciences, Gulbarga. We observed an unusual variation in the vascular supply to the kidney on the left side of a 49 years male cadaver. We observed accessory renal artery to supply apical segment and posterior segment is directly coming from abdominal aorta.

**KEY WORDS:** Renal Artery, Renal Vasculature, Nephrons, Variations, Abdominal Aorta.

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### INTRODUCTION

The renal arteries are large, paired arteries which take origin from the lateral aspect of aorta at the level of upper part of L2 (second lumbar vertebra) little below the origin of superior mesenteric artery. The left renal artery (LRA) is usually little higher than right one, it passes posterior to left renal vein (LRV) and then enters left kidney (LK). Near the hilum renal artery divides in to anterior and posterior divisions which intern divides in to different segmental arteries and supplies the respective segments of the kidney being they the end arteries [1].

### CASE REPORT

In the present case report, during routine

abdominal dissection conducted in 49 years male cadaver while teaching medical under graduates, we observed a variation in the segmental branching pattern of renal artery of left kidney. The hilar region was dissected carefully and taken photographs.

### RESULTS

**Left kidney:** Length- 9cm, width at upper part- 5cm, width at lower part- 3.5 cm, thickness- 2.8cm.

**Main renal artery:** Arose from aorta just below the level of right renal artery and it run towards the left kidney. It has divided in to upper and lower branches 4cm from aorta 3cm from hilum.

Upper division has given branch to upper

segment and continuous as artery for middle segment and supplies to it by dividing in to 2 lobar arteries 8mm from hilum.

Lower division run obliquely downwards and towards the lower pole and supplied to the lower segment by dividing in to 2 lobar arteries 15mm from the hilum.

**Accessory artery (assuming as posterior division of renal artery):** It arose from aorta just below and behind the main renal artery and run towards the left kidney just below and the main renal artery. It has given branch to the apical segment as superior renal polar artery about 3.5cm from the aorta and divides into 3 lobar arteries for supplying the posterior segment and it is present in between pelvis of ureter anteriorly vein of upper part of the kidney.

**Fig. 1:** MRA (Main renal artery, ARA (Accessory renal artery), ASA (Apical Segmental artery), SSA (Superior segmental artery), MSA (Middle segmental artery). ISA (Inferior segmental artery).



**Right kidney:** Length- 8.3cm, width at upper part -7.5cm, width at lower part- 3cm, thickness- 3 cm.

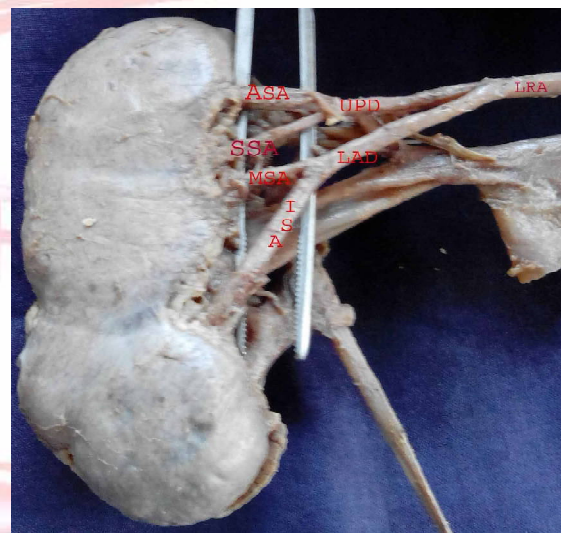
Right renal artery arose from aorta just above the level of left renal artery, it has given lower anterior and upper posterior divisions 5cm from aorta. Lower Anterior branch run obliquely downwards and towards the hilum and 1.5 cm from hilum divided in to middle and inferior segmental arteries and they have supplied to the respective segments. These arteries for middle and lower segments lie in front of the

renal vein.

Upper anterior division arose from renal artery around 5cm from aorta, 3.5 cm from hilum and it divides in to apical and superior segmental arteries about 1.5 cm from hilum and supplied corresponding segments.

The continuation of right renal artery runs vertically down downwards along the hilum as posterior segmental artery and giving many lobar arteries along its course to the posterior segment.

**Fig. 2:** LRA (Left renal artery), LAD (Lower anterior division), UPD (Upper posterior division), SSA (Superior segmental artery), ASA (Apical segmental artery), MSA (Middle segmental artery), ISA (Inferior segmental artery).



## DISCUSSION

Gradually the kidney ascends and reaches the iliac fossa after crossing the pelvic brim, here it get blood supply from common iliac arteries. Finally it appears on the under surface of diaphragm where its ascent is arrested by supra renal gland which has meanwhile developed in this region. Here kidney receives the blood supply from lowest supra renal artery and this branch persist after birth as permanent renal artery. Accessory artery is remnant of degenerated mesonephric artery [2].

Double renal arteries with an aortic origin are frequent vascular variations, representing the persistence of the embryonic vessels, the lateral branches of the mesonephros, within the renal ascent [3].

Knowledge of the existence of aberrant renal arteries is important because they may be

inadvertently damaged during renal surgery and their presence must be considered in evaluating a donor kidney for possible renal transplantation. Persistence of certain of the cephalic mesonephros vessels, however, may result in the arterial abnormalities [4].

Different origins of the renal arteries and its frequent variations are explained in various literatures owing to the development of mesonephric arteries. These mesonephric arteries extend from C6 to L3 during the development. Most cranial vessels disappear while the caudal arteries form a network, the rete arteriosum urogenitale that supplies in future the metanephros. The metanephros in future develops into adult kidney deriving its blood supply from the lowest suprarenal artery which gives out a permanent renal artery. Persistent roots of the network form these segmental arteries of the adult kidney having variations at their point of origin. The kidney grafts with multiple arteries resulted in post-transplant morbidity and graft loss following the ligation of the polar arteries. The transplantation of the kidney with the single renal artery is technically easier compared to the kidney with multiple arteries [5].

The nomenclature of the variations of the renal arteries is still not clear, as different authors described them as additional, accessory, hilar, inferior and superior polar arteries. We named our renal arteries as double renal arteries [6].

Bordei et al. found 54 double renal arteries originating from the aorta in 272 kidneys (20%); six of them were bilateral (2,2%) [7].

Double renal arteries usually arise from the abdominal aorta, that entered the kidney through the hilum, the one with a larger caliber and thus supplying a larger renal territory, was designated the main renal artery and the other as the hilar supplementary renal artery.[7]. In recent years, interest in the surgical and medical aspects of double renal arteries has been high because during renal surgical procedures, besides hemorrhage and loss of renal parenchyma, arterial lesions may induce segmental ischemia followed by hypertension. The presence of double renal arteries increases the complexity of renal transplantation; kidneys with double arterial supply being involved in a higher

percentage of transplant failures than kidneys showing no variation [7.].

Satyapal et al. described double renal arteries in 31.3% of the African population in their study, 30.9% of the white population, 18.5% of the half-caste population and 13.5% of the Indian population [8]

There were early divisions in 67 (8%)patients, 32% of which occurred on the right side, 25% on the left, and 22% on the both sides [9].

10 also reported double renal arteries, First renal artery (RA) arose from aorta at the level of L1 vertebra, whereas 2nd renal artery arose from same 5 cm below to the first one. Both RA ran laterally and entered the kidney through the hilum with their anterior and posterior divisions. One branch (superior polar artery) of 1st renal artery arose from 0.5 cm away from main origin, ran supero-laterally to reach the upper pole of the kidney and supplied it. Anterior division of 1st RA divided into 4 segmental arteries (1 apical, 1 upper, 2 middle) having intrarenal course, whereas 2nd RA gave 2 segmental arteries (1 middle and 1 lower). Posterior division of 1st RA gave 2 (apical) whereas that of 2nd gave 6 (2 upper, 2 middle, 2 lower) segmental arteries [10].

11 had reported that the aberrant right renal artery originated at the level of lower border of L1 vertebra along with the origin of the normal right renal artery. This aberrant renal artery had a parallel course with that of the right renal artery lying superior to it. The trunk of the aberrant renal artery entered the kidney from its anterior surface through its capsule giving off branch to the upper pole called superior polar artery. Further this artery gave a posterior branch that was entering the capsule of the right kidney from its posterior surface almost close to its medial border behind the hilum. This aberrant artery gave a branch to the right suprarenal gland, the inferior suprarenal artery instead of the main renal artery supplying it. We also noticed an extra-capsular branch given off by the main right renal artery to the anterior surface in front of the hilum [11].

12 had reported that an unusual variation of double left renal arteries one below the other. The upper left renal artery (LRAU) was higher,



wider than the lower left renal artery (LRAL). The calibre of the left renal arteries was smaller compared to the right renal artery. The LRV crosses the midline by passing posterior to the abdominal aorta (RALRV) to enter IVC. On the right side, the renal artery & vein were normal [12].

Such a morphological expression is important due to these branches being erroneously interpreted as being additional arteries in diagnostic imaging studies and determines surgical complications in renal transplants; since the first 15 mm of the renal artery can be used for anastomosis with the recipient's iliac artery. It should also be emphasised that early ramification of the main renal artery and the presence of additional arteries represent exclusion criteria in laparoscopic renal surgery [13, 14].

Right renal artery was divided into two segmental arteries (anterior and posterior) 4 cm proximal to the hilum of right kidney (Figure 2). The main renal artery and the two branches of the common trunk were almost of same caliber. The arrangement of the structures in the hilum antero-posteriorly was right anterior segmental renal artery, right renal vein, right posterior segmental renal artery and ureter (Figure 3). Supero-inferiorly, the order at the hilum was: anterior segmental branch of the main right renal artery, right renal vein, posterior segmental branch and ureter. The renal vein at the hilum was found to be lying between the two segmental branches [15].

According to study by Gümüş H., et al. Renal artery originating from the level of L1-L2 intervertebral disc was found in 37.0% and 38.9% of patients on the right and left sides, respectively. Renal artery variations, including extrarenal artery (ERA), were found in 27% and ED (early division) in 26.7% of the patients [16].

The location of the renal artery according to origin from abdominal aorta was evaluated as origin of right renal artery above the origin of left renal artery 30 cases (60%), at the same level 14 cases (28%) and right renal artery lower to left renal artery 6 cases (12%). So origin of Right Renal Artery is little higher than Left Renal Artery in most cases [17].

## CONCLUSION

A sound knowledge of the anatomy and variation of the renal vessels such as its origin, length, diameter, number, course, branching patterns, structures present at hilum and their relations is very important surgeons and clinicians to planning and performing procedure for safe attempt of renal transplants, vascular reconstructions, while using non-angiographic, noninvasive methods for investigating renal artery stenosis, the kidneys in trauma management and various surgical and radiological techniques. Early division of renal arteries may constitute a danger in nephrectomy and in the partial resection of the kidney. The aim of present case report is humble effort to bring awareness to the surgeons and physicians about the variation in the vascular pattern near its origin course and ramification at hilum for the safe and effective surgical procedures without vascular damage.

**Conflicts of Interests: None**

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