

Case Report

Variation in Renal Blood Supply and Its Clinical Significance- A Case Report

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ABSTRACT

Variations in the arterial blood supply of kidney are becoming much important due to increasing number of surgical interventions related to kidney and adnexa. Generally each kidney is supplied by a single renal artery, arising from lateral sides of abdominal aorta and entering it through hilum. Presence of extra renal arteries is accountable in cases of renal pathologies, radiological diagnostic procedures, renal transplant, urological and other surgical approaches. A case of anatomical variation of renal blood supply in bilateral kidneys was noted during routine dissection of a 63 year old male cadaver at Department of Rachana Sharir, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital, Hassan, Karnataka, India. Arising from the abdominal aorta, the right variant renal artery was entering the substance of right kidney through its lower pole while the left variant renal artery was entering the respective kidney through hilum. This case report will make the academicians, physicians, radiologists, surgeons aware about the possible presence of variations in blood supply of kidneys.

Key Words: kidney, accessory renal artery, extra renal artery, variant renal artery, renal transplant

INTRODUCTION

A pair of renal arteries is the normal vascular supply to the kidneys. Each renal artery normally arises from lateral aspect of abdominal aorta just below the level of origin of the superior mesenteric artery, approximately at the level of L1 and L2. The right renal artery, which is longer and often higher than the left one, passes laterally behind the inferior vena cava, right renal vein, head of pancreas and descending part of duodenum while the left renal artery passes laterally behind the left renal vein, the pancreas and the splenic vein. Each artery gives off inferior supra renal and ureteric branches and then divides into anterior and posterior division at or very close to the hilum and enters kidney. Further each divides into segmental and other

successive smaller branches which are the end arteries. Normally, a single renal artery supplies to each kidney in 70% of population but about 30% of population have been found to have one or more extra renal arteries, usually arising from the aorta above or below the main renal artery and following it to the renal hilum or passing to upper or lower pole. [1-3]

The presence of more than one renal artery in unilateral or bilateral kidney has been observed in different studies. Their incidence shows social, ethnic and racial differences. It occurs 37% in Africans, 35% in Caucasians and less than 17 % in Hindu and the other populations. [4]

CASE REPORT

During routine gross anatomy dissection of abdominal region in a 63 year old male cadaver with heavy built at Department of Rachana Sharir, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital, Hassan, Karnataka, India, it was observed that both the kidneys were supplied with more than one renal artery.

1. Variation observed in blood supply of right kidney

It was observed that the principal renal artery was emerging as a para aortic branch at the level of L2 vertebra and slightly below the level of origin of superior mesenteric artery and it was coursing posterior to the inferior vena cava, right renal vein and descending part of duodenum with pancreatic head. The diameter of terminal part of renal artery before its lobar branches as it enters the hilus of kidney postero-superiorly was more when compared to the proximal part.

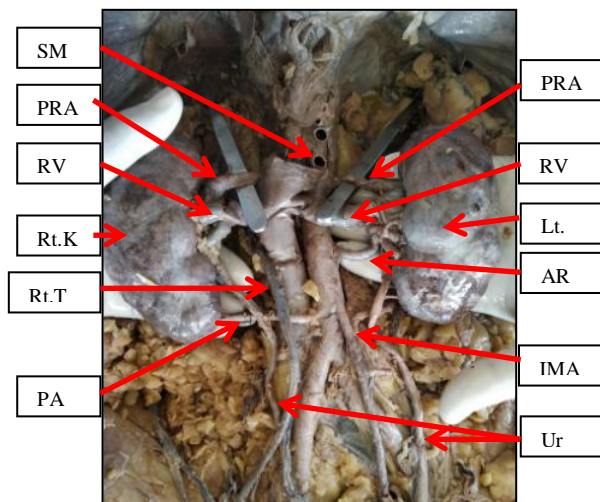


Figure 1: Kidneys with blood vessels in situ
PRA-Principal Renal artery, IVC-Inferior vena cava, Ao-Aorta, ARA-Accessory renal artery, Ur-Ureters, PA-Polar artery, Rt.TV-Right testicular vein, IMA-Inferior mesenteric artery, SMA-Superior mesenteric artery, Rt.K-Right Kidney, Lt.K-Left kidney, RV-Renal vein

Right kidney was supplemented by an extra renal artery emerging from abdominal aorta as pre-aortic branch 8 cm below the origin of principal renal artery and 2.5cm above the bifurcation point of aorta on the right side of origin of inferior

mesenteric artery. It was coursing laterally, upwards and to the right by passing anterior to inferior vena cava, then posterior to right testicular vein, ureter and entered the kidney at its lower pole. It was comparatively thinner than the principal renal artery.

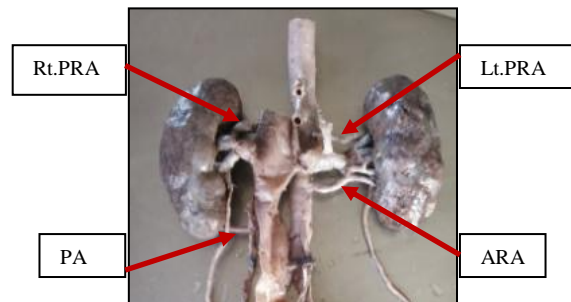


Figure 2: Anterior view
Lt.PRA - Left principal renal artery, Rt. PRA- Right principal renal artery, ARA-Accessory renal artery, PA- Polar artery

2. Variation observed in blood supply of left kidney

It was observed that on the left side, there were 2 renal arteries, both entering the hilus of kidney. The renal artery which was emerging superiorly as para-aortic branch at the level of emergence of superior mesenteric artery was considered as principal renal artery as its origin, course and branching pattern was similar to normal one.

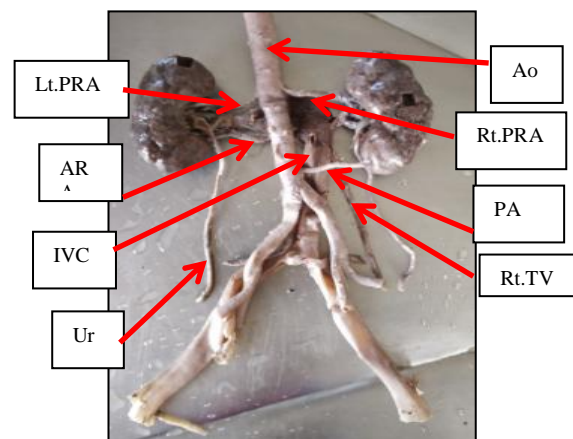


Figure 3: Posterior View
Lt.PRA - Left principal renal artery, Rt. PRA- Right principal renal artery, IVC-Inferior vena cava, Ao-Aorta, ARA-Accessory renal artery, Ur-Ureter, PA- Polar artery, Rt.TV-Right testicular vein

The variant accessory artery was emerging as para-aortic branch at a distance

of 4.5 cm below from principal renal artery. After coursing upwards and laterally to the left for a distance of 4cm, it was divided into two branches. The superior branch redivided before entering the hilus of the kidney anterior to the tributaries of renal vein and renal pelvis. The calibre of accessory artery was larger than that of principal renal artery.

DISCUSSION

Kidneys develop from two distinct sources of intermediate mesoderm. Excretory tubules are derived from the lowest part of the nephrogenic cord, the metanephros while collecting part is derived from ureteric bud of mesonephric duct. At first, the metanephric kidney lies in the pelvic cavity and receives blood supply from median sacral artery. In subsequent development of embryo, differential growth of the abdominal wall causes the kidney to ascend upward to the iliac fossa and receives the blood supply from common and internal iliac arteries. Finally, ascent of kidney is arrested by the diaphragm where it gets permanent arterial supply from the lowest supra renal artery and persists as definitive renal artery. These arteries represent the lateral splanchnic branch of aorta at the level of second lumbar vertebra. [2,5]

The developing mesonephros, metanephros, suprarenal glands and gonads are supplied by nine pairs of lateral mesonephric arteries arising from the dorsal aorta. Among them, the third to fifth pairs give rise to the renal arteries. On the course of further development, these arteries degenerate, leaving only one mesonephric artery in each side, which persists as a definitive renal artery. Persistence of more than one arteries of the middle group results in multiple renal arteries. [6]

Regarding the arterial terminologies to describe extra renal vessels like supernumerary, multiple, aberrant, additional and so on is still confusing and controversial. Some authors divide the renal arterial variants into 2 groups: Early Division and Extra Renal Artery. When the

principal renal artery divides into segmental branches more proximally than the renal hilus level, it is called early division. Presence of the artery other than the main renal artery supplying the kidney is termed as extra renal artery which may be used with a sub classification into Accessory or Hilar artery and Polar or Aberrant artery. Accessory arteries are those which enter the kidneys from the hilus with the main renal artery, whereas the arteries entering the kidneys directly from the capsule outside the hilus are called Aberrant arteries. When these enter the kidney at the pole, they are called Polar arteries. [4] In the present case, the right kidney was supplemented by an extra artery entering at the pole while the left kidney was supplied by extra renal artery entering through the hilus, so, we considered them as Polar and Accessory arteries respectively. There was early division in left extra renal artery. One different view states that the artery arising from the aorta or main renal artery should be called as Accessory and all other sources as Aberrant artery. [7] Some opine that it is misnomer to call such vessels accessory, aberrant or Supernumerary because they are not extra but essential tissue sustaining arteries. They do not anastomose with each other and correspond to the segmental branches of a single artery. Injury to these arteries leads to ischaemic necrosis of the parts of the kidney that they supply. [8,9]

Incidence of multiple renal arteries has been reported to be 20.2% on the right and 19% on the left side. [10] These arteries vary in their level of origin, in calibre, obliquity and precise relation. Accessory renal arteries commonly originate from the abdominal aorta and rarely from single trunk, common iliac, and superior mesenteric or inferior mesenteric arteries. In addition, variations in number like double, triple, and four renal arteries have been reported. [11] A case of both right and left renal arteries arising from abdominal aorta by a single trunk has been reported by Levene ND [12] while Asala et al has reported the renal arterial variant arising

from common iliac artery. [13] Origin of accessory renal arteries from superior and inferior mesenteric arteries has also been reported. [14,15] Ozkan U et al in their study in 855 patients observed multiple renal arteries in 24%, bilateral multiple arteries in 5%, early division in 8%. In addition, they reported triple renal arteries 1% and 0.7% on right and left sides respectively and 4 left renal arteries in 0.2% of cases unilaterally in the left side. [4] In the present study, we found a right polar artery as a pre-aortic branch arising 2.5 cm above the bifurcation of abdominal aorta. It was passing anterior to inferior vena cava, then posterior to testicular vein and ureter. On the left side, an accessory artery was arising as para-aortic branch of abdominal aorta 4.5 cm below the principal renal artery and passing slightly upwards and to the right to reach the hilum.

Clinically, the extra renal arteries are very important anatomical variants. The lower polar or accessory artery that crosses the ureter anteriorly can be a cause of obstruction at ureteropelvic junction leading to hydronephrosis or it may dispose to varicocele when crosses the testicular vein. Being the end arteries, the damage or ligation to these can lead to a decreased blood supply and subsequent infarction. [6,16]

Renal transplantation is technically easier to those kidneys that have single renal artery. Failure rate of renal transplantation increases with increase of extra renal arteries as all the extra renal and the main renal arteries of the donor kidney must be surgically anastomosed to be certain to completely perfuse the kidney. Post surgical complication and the risk of kidney loss is higher in the cases of multiple renal arteries. [4,16]

The accessory renal arteries have also been associated with arterial thrombosis and stenosis. Considering such kidneys for grafting would invariably endanger both living donor and recipient. [9] In addition, such variations are very important subject of consideration during pyeloplasty, nephrectomy and other surgical

and radiological procedures of kidney and adnexa. [17]

CONCLUSION

Existence of high incidences of extra renal arteries in the common population is important from the academic, radiological and surgical point of view. Anatomical knowledge of varieties of renal arterial variants is essential during angiographic interventions, abdominal surgeries such as exploratory, aortic aneurism repair, renal transplantation, urological and other adnexal surgeries. This necessitates the proper knowledge of renal vasculature prior to any surgical procedures in order to avoid or minimize the post surgical complications.

Conflict of Interest: I have no conflict of interest.

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