

*Case Report***Presence of Bilateral Multiple Renal Arteries and Their Variable Course:
A Case Report**Arvind Deswal¹, Asif Ahamad Khan¹, Anju Bala², Sunaina Grover²¹Department of Anatomy, SGT Medical College, Hospital and Research Institute, Gurgaon, Haryana, India.²Department of Anatomy, BPS Govt. Medical College for Women, Khanpur Kalan, Sonapat, Haryana, India.

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*Received: 01/04/2015**Revised: 21/04/2015**Accepted: 23/04/2015***ABSTRACT**

Knowledge about the variations in the origin of renal arteries is essential for the clinicians and surgeons to perform renal transplantation, interventional radiological procedures and renal vascular operations more safely and efficiently. Usually, the renal arteries take origin from the lateral aspect of aorta below the origin of superior mesenteric artery at the level of L₂ vertebra. During routine dissection of 35-year-old male cadaver, we found triple renal arteries with its segmental branches for the right kidney and double renal arteries for left kidney and also seen the origin of left inferior phrenic artery from celiac trunk. The incidences of variation of renal arteries are about 30%. Knowledge of the unusual variations of the renal arteries is necessary for selection of kidney donor as well as during nephrectomy and segmental resection.

Key words: renal transplantation, superior mesenteric artery, kidney, variations, segmental branches.

INTRODUCTION

The renal arteries are the lateral branches of the abdominal aorta arising inferior to the origin of superior mesenteric artery, between the upper edge of the L1 and the lower edge of L2. In approximately 70% of subjects, a single renal artery is present for each kidney and in 30% of subjects, accessory renal arteries are common and usually arise from the aorta above or below the main renal artery and follow it to the renal hilum. These are regarded as persistent embryonic lateral splanchnic arteries.^[1] The presences of multiple renal arteries increase the complexity during renal surgeries. Due to increasing frequency of renal transplantation day by day, surgeons, before

operating the patients, should be aware about the presence of multiple renal arteries and their variant courses to prevent post-operative complications.

CASE REPORT

While in routine abdominal dissection for teaching MBBS students, we observed variation of renal arteries in 35-year-old male cadaver. Dissection was done according to the guidelines of Cunningham's practical manual. We observed bilateral multiple origins of renal arteries and also origin of the inferior phrenic artery from celiac trunk on the left side. (Figure-1,2)

On the right side, triple renal arteries with different level of origin from lateral part of aorta were seen. Upper renal artery arose from the lateral part of aorta 1cm below the origin of superior mesenteric artery at the L₁ level. Then, it passed laterally behind the inferior vena cava towards the hilum of kidney. Near the upper pole of kidney, it gave superior polar artery which entered directly into the upper pole of kidney. Then, near the hilum, it was dividing into apical, anterior, and middle vascular segmental branches. Inferior segmental branch entered into upper hilum passing anterior to renal vein. (Figure-1,2)

Middle renal artery arose from the lateral part of abdominal aorta at the upper part of L₂ level and passed laterally behind the inferior vena cava and entered into the kidney through middle part of hilum. (Figure-1,2)

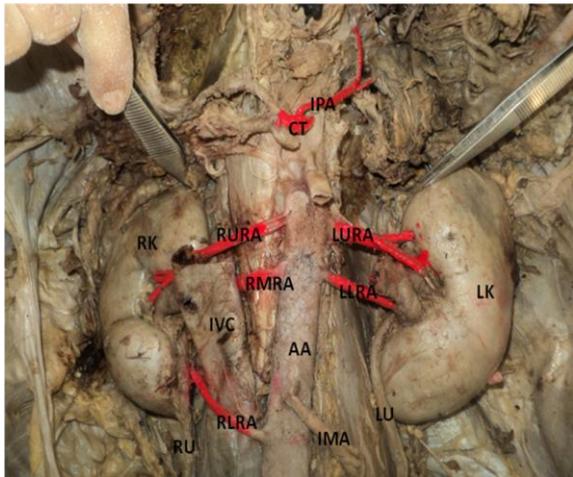


Figure 1- multiple bilateral renal arteries and left inferior phrenic artery originated from celiac trunk.
(CT- celiac trunk, IPA- inferior phrenic artery, RURA- right upper renal artery, RMRA- right middle renal artery, RLRA- right lower renal artery, IVC- inferior vena cava, RK- right kidney, RU- right ureter, AA- abdominal aorta, LK- left kidney, IMA- inferior mesenteric artery, LU- left ureter, LURA- left upper renal artery, LLRA- left lower renal artery)

Inferior renal artery arose from the lateral part of aorta at the lower part of L₃ vertebra and was seen coursing in front of the inferior vena cava and entered into lower

and posterior part of hilum of kidney behind the pelvis of ureter. (Figure-1,2)

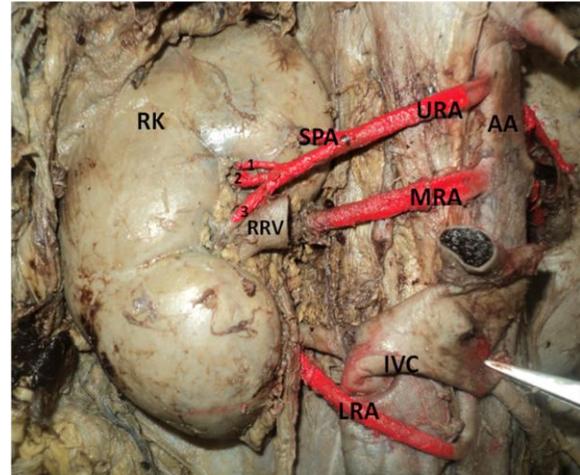


Figure 2 – multiple right renal arteries with its segmental branches .
(AA- abdominal aorta, URA- upper renal artery, MRA- middle renal artery, LRA- lower renal artery, IVC- inferior vena cava, RRV- right renal vein, RK- right Kidney, 1- apical segmental branch, 2- anterior segmental branch, 3- middle segmental branch)

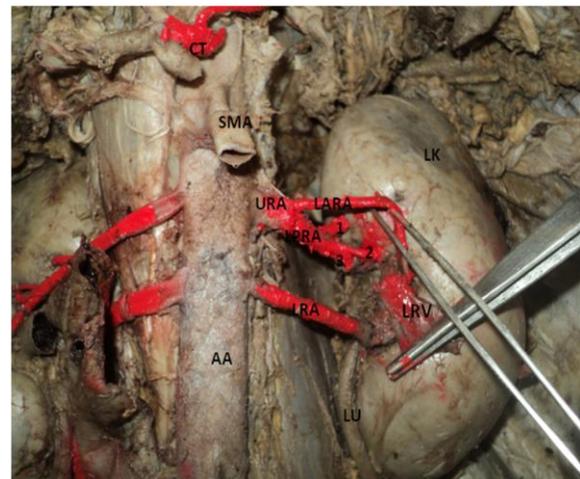


Figure 3 - left renal artery with segmental branches of left kidney.
(URA – upper renal artery, LARA- left anterior renal artery, LPRA- left posterior renal artery, SMA- superior mesenteric artery, LRV- left renal vein, AA- abdominal aorta, LU- left ureter, 1- superior polar artery, 2- anterior segmental artery, 3- posterior segmental artery, LK- left kidney)

On left side, two renal arteries were seen. Upper renal artery arose from lateral part of aorta at L₁ level and was divided into left anterior renal artery which directly entered into hilum of kidney and left posterior renal artery which gave superior

polar artery and anterior and posterior vascular segmental branches. Lower renal artery arose from lateral part of aorta at the L₂ level and entered into kidney through lower part of hilum. (Figure-3)

DISCUSSION

Presence of accessory renal arteries and abnormalities of renal arteries are due to the various developmental positions of the kidney. The kidneys begin their development in the pelvic cavity. During further development, they ascend to their final position in the lumbar region. When the kidneys are located in the pelvis, they are supplied by the branches of internal iliac or common iliac arteries. While the kidneys ascend to the lumbar region, their arterial supply also shifts from common iliac artery to the abdominal aorta. Accessory renal arteries originate from the abdominal aorta either above or below the main renal artery and reach the hilum. [2] It is important to be aware that accessory renal arteries are end arteries; therefore, if an accessory artery is ligated or damaged, the part of kidney supplied by it is likely to become ischemic.

The renal vascular segmentation was discovered by John Hunter in 1794, but a detailed account was given in 1950's by Corrosion Cast studies. There are five defined arterial segments: apical, superior, middle, inferior and posterior. The anatomical knowledge of these segments is important while performing nephrectomies. [1]

In the present case, we found triple renal arteries on the right side and double renal arteries on the left side of different level of origin from the lateral part of aorta. On the right side, upper renal artery was divided into apical, anterior, middle and inferior vascular segmental branches and also gave superior polar artery near the upper pole of kidney. On the left side, left posterior renal artery gave superior polar

artery and anterior and posterior segmental branches.

Budhiraja et al 2010 observed prehilum multiple branching of renal arteries in 11 (11.66%) cases, duplication of renal arteries in eight cases (8.33%), superior polar arteries in 7 cases (6.66%). Prehilum branches were directed towards apical, superior, middle, inferior and posterior vascular segment of kidney. [3] In the present case, inferior renal artery on the right side was seen to pass superficial to inferior vena cava after taking origin from the lateral part of aorta at the level of L₃. Similar case was observed by Kumar RRV (2013). [4]

According to Hollinshead, the level of origin of renal artery is important topographically as right renal arteries which arise at a lower level typically pass in front of the inferior vena cava instead of behind it. He also gave a developmental explanation that the inferior vena cava below the level of kidney usually develops from a dorsally placed supracardinal system of veins while that at the level of kidney develops from a ventrally placed subcardinal system of veins. Thus, inferior vena cava is placed ventral to the right renal artery at a higher level and dorsal to it at a lower level. [5]

Right renal arteries crossing anterior to the vena cava have been implicated in as one of the cause of uretero-pelvic junction obstruction. A right renal artery that passes ventral to the inferior vena cava is important for pre-surgical planning, because of chances of its injury especially during the retro-peritoneal approach, when only the right gonadal vein is expected to lie in the precaval area. This anterior origin may also result in misidentification at laparoscopy of such vessels as the inferior mesenteric, superior mesenteric or hepatic artery. [6]

The knowledge about multiple renal vessels has importance with increasing numbers of vascular anastomosis in renal transplant surgeries and also for different

radiological and surgical procedures. Therefore, multiple renal arteries should be considered with great care during transplantation of kidneys as the post surgical complication rates are comparatively higher than those with fewer arteries. Routine arteriography should be considered a standard prerequisite in the evaluation of potential living related renal donors. [7]

According to Pick and Anson, inferior phrenic artery originated from coeliac trunk in 13% cases. The knowledge about this type of variation is important for surgeons in order to avoid accidental sectioning of small caliber arteries that may occur during the decompression of coeliac artery in the compression syndrome of celiac trunk by median arcuate ligament. [8]

CONCLUSION

Anatomical variations in the origin of the renal arteries may have importance for the urologists while performing nephron-preserving surgery, kidney transplantation and the management of renal vascular hypertension. Knowledge of anomalous vessels serves as the important guidelines before surgery, reduces the risk of trauma to the vessels and ensures through vascular ligation and anastomosis. So, to avoid any vascular complication, multi detector computer tomography (MDCT), angiography and arteriography should be performed prior to every nephrectomy.

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