

Case Report

MULTIPLE RENAL ARTERIES: ITS CLINICAL IMPLICATIONS

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ABSTRACT

The peculiarity of renal vascular variations challenges the surgeons and interventional radiologists with the task of defining the singular pattern of origin and entry of arteries into the kidney. Presence of multiple renal arteries is a perplexing predicament for the surgeon during interventional procedures as there are uncertainties about the future outcome. The present study reports a variant renal vasculature and aspires to emphasize its embryological basis and surgical implications. During routine cadaveric dissection, we observed three renal arteries arising separately from the abdominal aorta and entering the left kidney at the hilum. The inferior suprarenal artery emerged from the most superior renal artery while the inferior most renal artery crossed superficial to the ureter to enter the hilum. The persistence of mesonephric arteries is the culprit in most renal vascular variants as was seen in the present study. Morphometric analysis revealed the three arteries had similar dimensions with different angulations that suggested a possible role in segmental ischemia of the kidneys. An aberrant renal vasculature is treated with suspicion and thought to increase the complexity of anastomotic techniques. A thorough knowledge of the arterial patterns may lead to higher success rate of transplantation of kidneys with variant vasculature.

KEY WORDS: Abdominal Aorta, Accessory renal artery, mesonephric arteries, Suprarenal artery

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INTRODUCTION

The renal arteries are a pair of lateral branches of the abdominal aorta that constitute the primary arterial supply of the kidneys and part of the suprarenal glands. In approximately 70% individuals, each kidney is supplied by a single renal artery while in 30% population, the accessory renal arteries are the most common variant of the renal vasculature which may vary in origin, course, calibre or number [1]. The super-numerary renal arteries are categorized

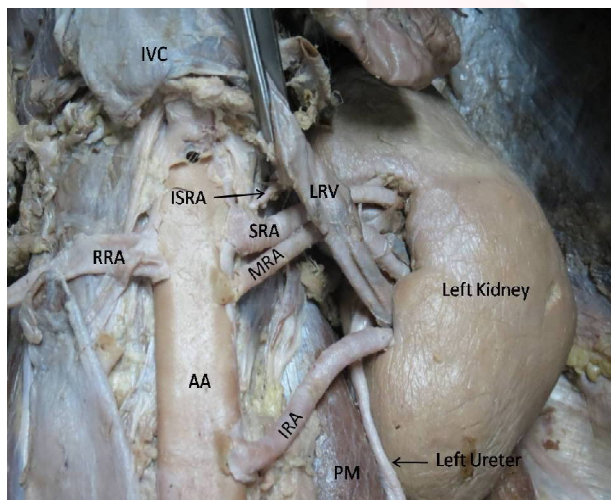
into two groups: the hilar /accessory arteries (which enter the hilus of the kidney with the main renal artery) and the polar aberrant arteries (enter kidneys from outside the hilus) [2]. We report a case of three unilateral left renal arteries arising separately from the abdominal aorta and entering the hilum of the left kidney without any associated renal anomaly. The documentation of such variant arterial patterns is imperative for academic, surgical as well as radiological procedures as incessant use of invasive instrumentation

in renal trauma, reno-vascular hypertension, renal transplantation and arterial embolization procedures require thorough anatomical knowledge of renal vasculature and its anomalies.

CASE REPORT

Routine cadaveric dissection of the abdomen in a 50 year old male exposed a variant renal vasculature. The length and diameter of each artery was obtained using a surgical suture (mersilk) which was then measured by a Vernier calliper, while the angulations of the arteries were measured at their origin using a goniometer. The situation of the kidneys in the posterior abdominal wall was normal, extending from twelfth thoracic to third lumbar vertebra. The abdominal aorta (AA) presented with three separate renal arteries that entered the hilus of the left kidney [Figure 1]. At their site of origin from the aorta, the superior (SRA) and middle (MRA) renal arteries arose as lateral branches and were 4 mm apart while the inferior renal artery (IRA) arose 2.4 cms below the MRA as an antero-lateral branch [Figure 1].

Fig. 1: Photograph of dissected multiple renal arteries to the left kidney.



(Left superior renal artery (SRA), left middle renal artery (MRA) and left inferior renal artery (IRA) arising from abdominal aorta (AA) Also seen: Inferior suprarenal artery (ISRA) arising from SRA, left renal vein (LRV), left kidney, left ureter, left psoas major (PM), right renal artery (RRA), inferior vena cava (IVC))

The angles of SRA, MRA and IRA at their origin were found to be 85 degrees, 80 degrees and 70 degrees respectively. The lengths obtained were 4.1 cm, 5.3 cm and 4.7 cm while the diameters were 5.6 mm, 3.7mm and 4.2mm for

SRA, MRA and IRA respectively. The antero-posterior relationship of the hilar structures was found to be normal. Further, the inferior mesenteric artery arose 2.9 cm distal to the IRA and the inferior suprarenal artery (ISRA) was seen arising from the superior aspect of SRA. The right kidney and its hilar structures were found to be normal.

DISCUSSION

The chief arterial supply to a kidney is a single renal artery, which arises as a lateral branch of the abdominal aorta, at the level of L1-L2 vertebrae. Renal artery variations are divided into two groups: early division (ED) - more proximal branching of the main artery from the hilus and extra renal artery (ERA) [2]. During development, the renal arteries initially arise as branches of the common iliac arteries. As the kidneys ascend towards their normal anatomical location, they are provided with newer branches from the aorta. In the ninth week, when the further ascent of the kidneys is arrested on contact with the suprarenal glands, the most cranial branches from the aorta develop into the permanent renal arteries while the caudal branches involute [3]. Thus accessory renal arteries are derived from embryonic arteries that persist during ascent of the kidneys and variations are better appreciated by knowledge of the embryological renal vasculature.

Variations of the renal arteries have been demonstrated to differ according to ethnicity, laterality and frequency. Bouali O. et al (2011) reviewed CT scans of 120 French patients and found multiple renal arteries in 28.3% in the right and 26.7% of the left kidneys [4]. Saldarriaga B et al (2008) discovered additional renal arteries in 22.3% of Columbian population which was most frequent on the left side, while in the Turkish population, Mersa B. et al. detected multiple renal arteries in 8.1% cases [5] while Ozkan U. et al (2006) found accessory renal arteries in 24% patients [2, 5, 6]. The accessory renal arteries may also vary according to their number, site or level of origin. They may arise from the abdominal aorta, common iliac, internal iliac, inferior mesenteric and as low as the middle sacral artery [7]. In the present study, we found three left renal arteries originating

from the aorta. The increase in number of arteries supplying a kidney may create confusion with regard to their territorial distribution which is important in partial nephrectomy. Further, the different angulations of the arteries may lead to kinking and segmental ischemia. The inferior accessory renal artery was seen passing superficial to the ureter and surgeons should exclude the possibility of such accessory arteries obstructing the ureter prior to the surgical treatment of hydronephrosis.

Few researchers have reported a frequent association of multiple renal arteries with essential hypertension and conflicting data regarding this relationship is a cause for concern [8]. The long term implications of such findings further complicate the risk of using variant vasculature for renal transplantation, as future outcomes are fraught with uncertainties.

The anatomical knowledge of renal vasculature is of utmost importance for surgical procedures related to posterior abdominal wall such as renal transplantation, abdominal aortic aneurysm, ureteric surgery and angiographic interventions. Awareness of such variant anatomy can reduce the risk of bleeding, segmental ischemia and postoperative hypertension during urological and transplantation surgeries.

ABBREVIATIONS

AA- Abdominal aorta

SRA- Superior Renal Artery

MRA- Middle Renal Artery

IRA- Inferior Renal Artery

ISRA- Inferior Suprarenal Artery

ED- Early Division

ERA- Extra Renal Artery

Conflicts of Interests: None

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