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Case Report

Atypical twin renal arteries with altered hilar anatomy

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ABSTRACT

Twin renal arteries (superior and inferior) were encountered on the left side in a 58-year-old male Indian cadaver. Both the renal arteries took a tortuous course to the hilum. The inferior renal artery, labeled as the accessory renal artery travelled sinuously and anteriorly over the left renal vein to enter the inferior most part of the hilum. The superior artery, labeled as main renal artery bifurcated before the hilum and its two branches were placed anterior to the vein. Thus the normal anteroposterior disposition of structures viz. renal vein, renal artery and the renal pelvis was not seen. Such renal arteries having sinuous course with atypical sequence of structures at the hilum are of worth concern to the urologists performing renal angiography and to surgeons performing laparoscopies or renal transplantation. © **IJAV. 2009; 2: 124–126.**

Key words [twin renal arteries] [hilum] [renal pelvis] [angiography] [transplantation]

Introduction

Chief arterial supplies to the kidneys are the renal arteries (70%) branching from the aorta. Before reaching the hilum of the kidney, each artery divides into four or five branches; the greater number of these are anterior branches which lie between the renal vein and renal pelvis, the vein being in front, the pelvis behind, but one or more posterior branches may be situated behind the renal pelvis.

Variation in number and location of these arteries is noted during cadaveric dissections and angiograms [1–4]. Presence of an extra renal artery is one of the most frequent variations in the kidneys (25-30%). Such arteries are called accessory or aberrant renal arteries (ARA) [1,4–6]. Single, double, multiple renal arteries are reported as 17.6%, 3.3% and 1% respectively [7]. The ARA is clinically important for surgeons performing renal transplantation. All the accessory renal arteries along with the main renal artery of the donor kidney must be surgically anastomosed with the recipient's arterial vessel to attain complete perfusion for all the renal segments.

Graves divided each kidney into five segments according to the arterial supply, namely, apical, upper, middle, lower and posterior [8]. He postulated that each of these segments is supplied by its own segmental artery. The apical, upper, middle and lower segmental arteries usually originate from the anterior divisions of main renal artery (MRA), whereas the posterior segmental artery from the posterior division.

Extra renal arteries are divided into two groups: hilar or accessory and polar or aberrant arteries. Hilar arteries enter kidneys through hilum along with the MRA, whereas the polar arteries pierce directly through the capsule exterior to the hilus [9].

Accessory renal arteries vary in number from two to six and have a penchant for the left side. Three major types of ARA have been noted in relation to the MRA, namely hilar, upper and lower polar arteries.

Case Report

Cadaveric dissection during routine dissection hall teaching program for undergraduate medical students revealed twin renal arteries on the left side in a 54-year-old, male Indian cadaver. Both vessels were of similar caliber and branched from the lateral side of abdominal aorta. The proximal artery labeled as the main renal artery (MRA) was at the level of the intervertebral disc between L1 and L2, and the distal artery labeled as accessory renal artery (ARA) was placed at the level of body of L2 vertebra. The two, main and the accessory renal arteries were 0.8 cm apart at commencement. The distal renal artery was labeled as the ARA because it was longer, took a more sinuous course and was the inferior most at the hilum. While taking the sinuous course over left renal vein, the ARA was initially behind, then superior, then anterior and finally it was inferior to it as it

entered the hilum (Figures 1,2,3). The length of the MRA was 5.1 cm, and that of ARA was 5.7 cm.

The left renal vein was formed by joining of the two tributaries, superior and inferior at the left hilum. At the commencement, both arteries (ARA and MRA) were superior and posterior to the left suprarenal vein, which drained into the renal vein (Figure 1). The MRA bifurcated into a superior and an inferior branch 1.4 cm before entering the hilum. These branches were placed anterior to the superior tributary of left renal vein. The inferior branch of the MRA was seen sandwiched between the two tributaries of the left renal vein at the hilum (Figure 1).

Thus, the anteroposterior disposition of structures at the left renal hilum was; inferior tributary of renal vein, both branches of MRA and ARA, and the posterior-most was the superior tributary of left renal vein. The sequence of structures at the left hilum from above downwards was artery-vein-artery-vein-artery. The left kidney showed an intrarenal pelvis and the ureter was placed posteriorly at the hilum. The middle suprarenal vein crossed both, MRA and the ARA obliquely and drained into the left renal vein. The left testicular vein drained into the left renal vein at a right angle. No aberrant renal vessel was seen.

The right renal vessels exhibited usual anatomy. The right renal artery was measuring 6.6 cm in length, ran a straight course as compared to the twin left renal arteries (Figure 3). The sequence of structures at right hilum was typical viz. vein-artery-ureter antero-posteriorly, but the pelvis occupied intrarenal position on both sides.

Discussion

Experiments on plastic casts and segmental renal angiography prove that there is no collateral arterial circulation between segments of kidney. It is seen that ligation of a segmental artery leads to ischemia and subsequent necrosis of the renal segment [8].

An accessory renal artery is derived from the persistence of embryonic vessels formed during ascent of the kidneys. These arteries usually arise from aorta and enter the superior or inferior poles of the kidneys [10]. The metanephric kidney begins development at sacral level and subsequently migrates cranially. The definitive renal arteries develop as a capillary network "rete arteriosum urogenitale" branching off from the aorta as segmental lateral splancnic arteries [11]. Persistence, enlargement and differentiation of some of these capillaries that usually regress give rise to variations of renal arterial supply such as ARA [11]. The other factors that regulate the regression of the caudal arteries and persistence of the cranial ones are oxygenation, nutrients, genetic and chemical factors [11–13].

In an anatomical study of morphology of the main renal artery, arteriograms of 81 kidneys were examined [14].

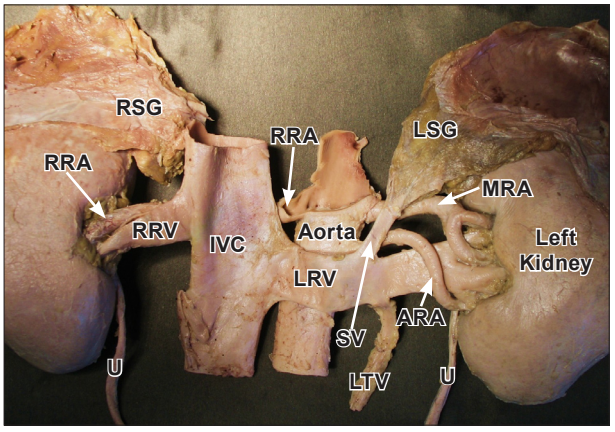

Figure 1. Anterior view of the dissected specimen showing sinuous course of *main renal artery* ***(MRA)*** and the *accessory renal artery* ***(ARA)*** on the left side. Note the atypical hilar anatomy. The *left suprarenal vein* ***(SV)*** crosses MRA as well as the ASA obliquely to drain into the *left renal vein* ***(LRV)***. ***(IVC:*** *inferior vena cava;* ***RRV:*** *right renal vein;* ***RRA:*** *right renal artery;* ***RSG:*** *right suprarenal gland;* ***LSG:*** *left suprarenal gland;* ***LTV:*** *left testicular vein;* ***U:*** *ureter)*

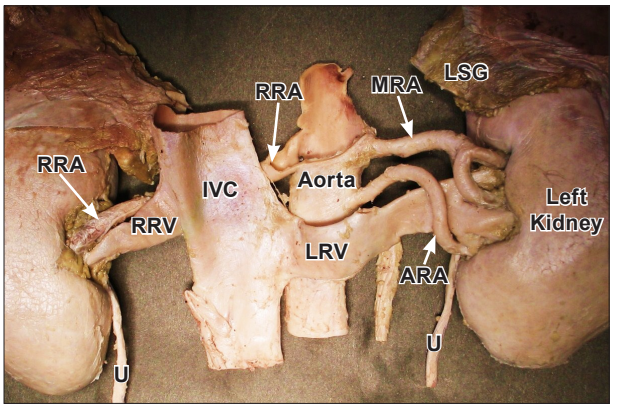

Figure 2. Part of the *left suprarenal gland* ***(LSG)*** and left suprarenal vein have been removed to expose the entire sinuous course of the *main renal artery* ***(MRA)*** as well as the *accessory renal artery* ***(ARA)***. ***(LRV:*** *left renal vein;* ***RRV:*** *right renal vein;* ***RRA:*** *right renal artery;* ***IVC:*** *inferior vena cava;* ***U:*** *ureter)*

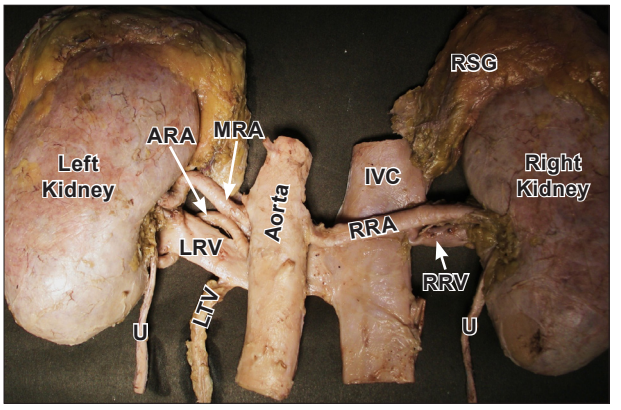

Figure 3. Posterior view of the dissected specimen. Note the straight *right renal artery* ***(RRA)*** in contrast to the sinuous course of the *main renal artery* ***(MRA)*** and the *accessory renal artery* ***(ARA)*** on the left side. ***(LRV:*** *left renal vein;* ***RRV:*** *right renal vein;* ***IVC:*** *inferior vena cava;* ***RSG:*** *right suprarenal gland;* ***LTV:*** *left testicular vein;* ***U:*** *ureter)*

Ten "infrequent" morphologies were found, their patterns showed alterations with the presence of a supernumerary renal artery. It was concluded that the peri-hilar branching of main renal artery is highly inconsistent, though this may follow certain patterns.

In a prospective analysis of angiograms and helical CT-scans of 40 patients to determine the topography of the origin, implantation angle and initial course of the renal arteries in the transverse and frontal planes, it was emphasized that awareness of the anatomy of the origin and initial course of the renal arteries is important when considering vessel dilatation and the implantation of stents in the renal arteries [15]. However, the analysis couldn't find any parallel between the origin, sinuosity or angulation of the renal arteries, which could aid interventional procedures [15].

Presence of twin renal arteries on the left side, showing unusual sinuous path with altered renal hilar morphology becomes significant, since the left kidney is preferred for renal transplantation [16]. Such variations of renal vessels are also critical issues to a radiologist interpreting renal angiograms and to urologist performing laparoscopies.

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