

Bilateral additional renal arteries and an additional right renal vein associated with unrotated kidneys

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ABSTRACT

We report a rare anomaly of the kidneys and its vessels, which were found during the routine dissection of a 68-year-old male cadaver. The anomaly consisted of bilateral additional renal arteries originating from the abdominal aorta and an additional right renal vein accompanying the additional right renal artery. These anomalies were associated with unrotated kidneys with extrarenal calices and pelves. All the additional vessels were located posterior to the ureter with a close relationship to the ureteropelvic junction on the right side. Additional renal vessels arise as a result of the complicated development of kidneys and variations in the positional anatomy of the kidneys, and their vascular supply are of clinical importance.

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Since Estachius described a case of multiple renal arteries in 1552,¹ numerous anatomic variations regarding the vascularization of kidneys including presence of multiple arteries with or without congenitally abnormal kidneys, retroaortic course of the renal vein and abnormal origins of the renal arteries, have been reported in the literature.²⁻⁸ Although the occurrence of additional renal arteries displays a wide range between 8.7% and 75.7%, mostly it is reported that the average incidence of these arteries is approximately 30%⁹⁻¹¹ and these arteries pass more to the inferior pole rather than the superior pole of kidneys. Usually, additional renal arteries are associated with the congenital malformations as of the complex embryological development of the kidneys.¹

In our case, we report retroureteral additional renal arteries and a retroureteral additional right renal vein associated with unrotated kidneys which is an uncommon abnormality, and this condition is of considerable clinical importance.

Case Report. Bilateral additional renal arteries and an accompanying vein to the right additional renal artery were observed during the dissection of a 68-year old white male embedded cadaver. The kidneys were unrotated bilaterally with hili facing anteriorly resulting the extrarenal location of vessels, calyces and pelves. The abnormal rotation of the kidneys is often associated with ectopic kidneys; however in our case both kidneys were located in the lumbar region between L1 and L3. The right kidney was receiving 2 arteries from the abdominal aorta. The right main renal artery arose from the lateral wall of abdominal aorta at the level of the first lumbar vertebra. At the origin, it was 5mm in diameter, and its length was 4.2 cm from the origination to the hilum of the kidney. The right main renal vein was formed with the union of 2 branches at the hilum of the right kidney, and it was connected to the inferior vena cava. The diameter of the superior renal vein at the entering point into the inferior vena cava was 8.5 mm, and its length was 2.5 cm. The additional renal artery on

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the right side originated from the abdominal aorta at the level of the third lumbar vertebra lateral to the inferior mesenteric artery. At the origin it was 4.5 mm in diameter, and its length was 4.7 cm. After passing in front of the inferior vena cava, it was entering the hilum of the right kidney with a close relationship to the ureteropelvic junction. An additional renal vein was accompanying this artery, originating from the hilum of the right kidney and terminating at the inferior vena cava. This additional vein was 4mm in diameter, and its length was 2 cm. It was also passing posterior to the ureteropelvic junction at the hilum of the kidney. The left kidney was also receiving 2 arteries from the abdominal aorta. The left main renal artery arose from the lateral wall of the abdominal aorta at the level of the first lumbar vertebra. It was 6 mm in diameter, and its length was 2.9 cm. It was entering the left kidney from the hilum. The left renal vein originating from the hilum and terminating at the inferior vena cava was 9 mm in diameter, and its length was 6.9 cm. The left additional renal artery was originating from the lateral wall of abdominal aorta, 1.8 cm superior to the bifurcation at the level of fourth lumbar vertebra. It was 5 mm in diameter, and its length was 4.8 cm. It was terminating at the inferior pole of the left kidney passing posterior to the ureter (Figure 1).

Discussion. There is nonconformity in the literature regarding the nomenclature of renal arteries other than the main renal artery. They have been variously described as "accessory," "aberrant," "supernumerary," "supplementary," "multiple," "accessory aortic hilar," "aortic superior polar," "aortic inferior polar" and "anomalous". To facilitate accurate reporting of incidence of additional renal arteries. Satyapal et al⁹ made the following definition: An additional renal artery, other than the main renal artery, is one which arises from the aorta and terminates in the kidney. So in our case we use the term "additional renal arteries" for the same purpose. Abnormal rotation of kidneys, as in our case, often is caused by or related to additional vessels. Complex development of the kidneys through the 3 sets of excretory organs, pronephros, mesonephros and metanephros, and the ascent of the kidney from the pelvis to the lumbar region, along with its longitudinal rotation and simultaneous acquisition of a vascular supply, explain the common variations in the blood supply of kidneys associated with the congenital malformations.^{1,12,13} Atasever et al¹⁴ reported an accessory renal artery associated with a unilateral unrotated kidney and Nathan and Glezer¹⁵ reported accessory renal arteries arising from a common trunk associated with unrotated kidneys. In our case, we present an additional inferior polar artery on the left side and an additional hilar renal artery on the right side with an accompanying additional renal vein associated with unrotated kidneys. The role of additional renal vessels in the obstruction of ureteropelvic junction causing

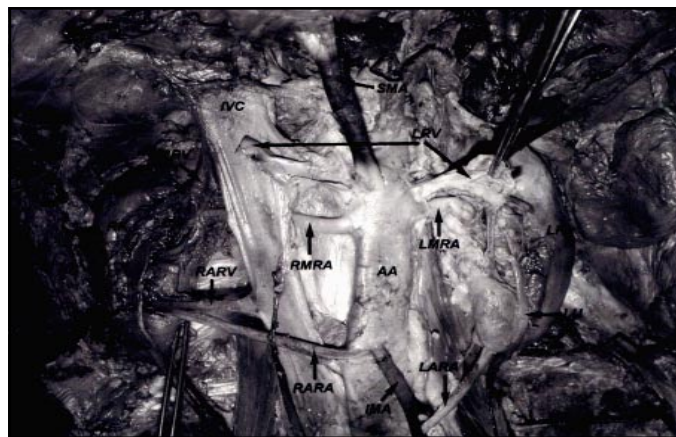


Figure 1 - Photograph showing unrotated kidneys with additional vessels. IVC - inferior vena cava, SMA - superior mesenteric artery, RMRV - right main renal vein, LRV - left renal vein, RK - right kidney, RARV - right additional renal vein, AA - abdominal aorta, LMRA - left main renal artery, LK - left kidney, RU - right ureter, RARA - right additional renal artery, IMA - inferior mesenteric artery, LARA - left additional renal artery, LU - left ureter.

hydronephrosis remains controversial, and the retroaretral presence of the variant is more likely to be associated with ureteropelvic junctional obstruction.^{16,17} In our case, the additional renal vessels were retroaretral on both sides. However, we did not detect any pathology related to hydronephrosis. Even with the close retroaretral relationship of large additional renal vessels with the ureteropelvic junction on the right side, the general size of the calices and the renal pelvis appeared normal.

Knowledge of the variations of the anatomy of the blood supply of the kidneys is important in the surgical treatments such as renal transplantation, vascular reconstruction of both congenital and acquired lesions and abdominal aortic aneurysms.^{18,19} Since the presence of renal vessels crossing posterior to the ureteropelvic junction influences the rate of hemorrhagic complications of endopyelotomy,²⁰⁻²² knowing the variations of large additional renal vessels located posteriorly to the ureteropelvic junction, as in our case, is very important.

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