Twisted renal vessels producing an abnormal shape of the right kidney

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ABSTRACT

The kidneys and the renal vessels are subject to a wide variety of variations. We report a rare variation of the right kidney and right renal vessels in a 60-year-old male cadaver. The right kidney was pyramidal in shape and the hilum was directed anteriorly. The right renal vessels were twisted against each other, and the inferior vena cava had a kink to the right side. Knowledge of this variation may be useful for the nephrologists, radiologists and surgeons.

Keywords: anatomical variation, kidney anatomy, renal artery, renal vein

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INTRODUCTION

The kidneys are situated in the para vertebral gutters, very close to the posterior abdominal wall. They are retroperitoneal organs. Each kidney has two poles (upper and lower), two borders (medial and lateral) and two surfaces (anterior and posterior). The upper pole is blunt and is related to the suprarenal gland. The lower pole is pointed. The medial border presents the hilum in its middle. The hilum admits the passage of renal vessels and renal pelvis. Each kidney is supplied with one renal artery and is drained by one renal vein; however, additional renal vessels have been reported. Anomalies of the kidneys are common. The commonest anomalies described include the non-rotation of the kidney, pelvic kidney, and horseshoe kidney. Most of the anomalies of the kidneys do not affect its normal function.

CASE REPORT

During a routine dissection class for undergraduate medical students, we noted a variation in the right kidney and its vessels in a male cadaver aged approximately 60 years. The right kidney was pyramidal in shape with a pointed upper pole and a broad lower pole. The hilum was situated on the anterior surface of the kidney (Fig.1). In the hilum, the renal vessels were located anterior to the ureter. The renal artery entered the hilum in the upper part and the renal vein left the hilum in the lower part. The right renal artery originated from the abdominal aorta and passed behind the inferior vena cava and had a twist around the right renal vein (Figs. 1 & 2). The artery was initially above the renal vein, and then it passed anterior, inferior and posterior to it, before reaching the kidney. The right ureter descended down freely without any kink. The inferior vena cava was pulled to the right at its junction with right renal vein (Fig.1). The shape of the left kidney was normal but its hilum was on the medial part of the anterior surface. It received two renal arteries from the abdominal aorta (Fig. 2). The left renal vein was formed by three large veins leaving the hilum of the kidney. It received the left suprarenal and testicular veins before it terminated into the inferior vena cava (Fig. 3).

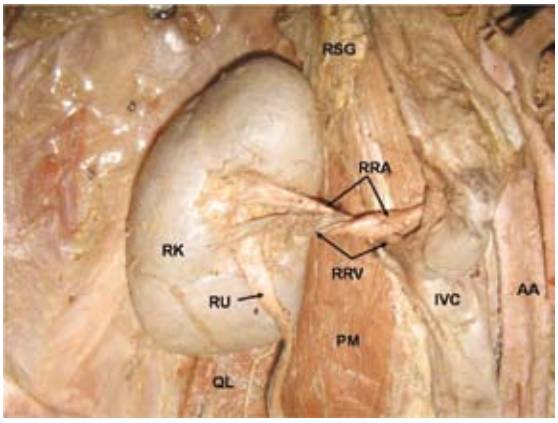

Fig.1 Photograph of the right kidney with twisted right renal vessels.
RK: right kidney; RRA: right renal artery; RRV: right renal vein; RSG: right suprarenal gland; RU: right ureter; PM: right psoas major muscle; QL: right quadratus lumborum muscle; IVC: inferior vena cava; AA: abdominal aorta.

DISCUSSION

The permanent kidney develops from the metanephros. The two kidneys start their development in the pelvis in front of the sacrum. They ascend to their final level due to the differential growth of the body. By the ninth week of foetal life, the kidneys reach the suprarenal glands, and after that, their ascent stops. In the beginning, the hilum of the kidney faces anteriorly but as the kidney ascends, the hilum rotates medially and comes to lie along the medial border.[1] Rarely, the kidney may rotate abnormally during its ascent. Chaudhary and Rao reported an abnormal rotation of kidney where the hilum faced posteriorly.[2] Abnormal rotations of the kidney might cause ureteropelvic obstructions.[3] The kidneys may fail to ascend or may ascend to the thorax in some cases.[4] Morishima et al

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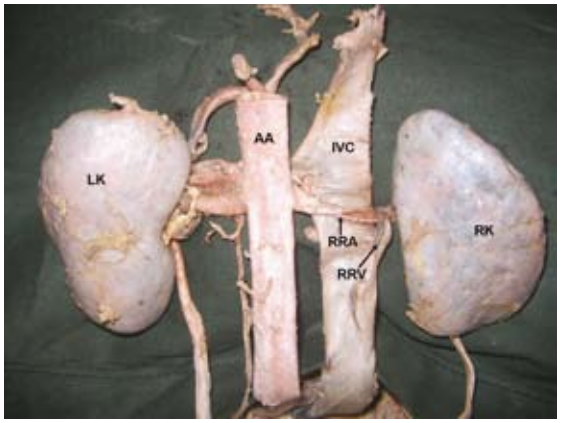

Fig.2 Photograph of the posterior view of both kidneys with renal vessels.
RK: right kidney; LK: left kidney; RRA: right renal artery; RRV: right renal vein; IVC: inferior vena cava; AA: abdominal aorta.

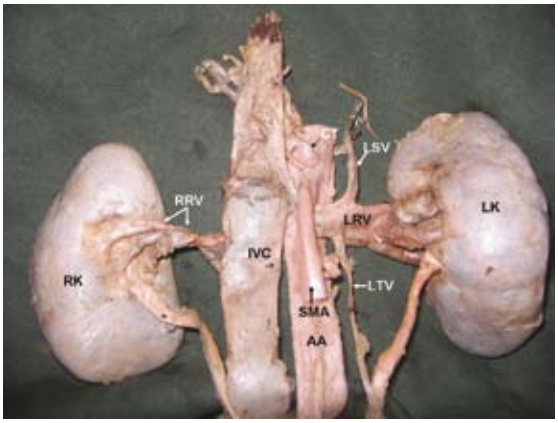

Fig.3 Photograph of the anterior view of both kidneys with renal vessels.
RK: right kidney; RRV: right renal vessels; LRV: left renal vessels; CT: celiac trunk; SMA: superior mesenteric artery; LSV: left suprarenal vein; LTV: left testicular vein; IVC: inferior vena cava; AA: abdominal aorta.

reported a diamond-shaped left kidney situated lower than usual, the hilum of which was widely opened and was facing anteriorly.[5] It was supplied by, in addition to an ordinal renal artery, four supernumerary arteries arising from the lower portion of the abdominal aorta and was drained by one ordinary and one supernumerary vein, the latter of which opened into the lumbar vein. A discoid-shaped ectopic kidney located in front of the right common iliac artery has also been reported.[6] This kidney also had associated vascular variations or renal vessels.

The renal arteries arise from the aorta just below the level of origin of the superior mesenteric artery. The kidney derives its arterial supply locally during its ascent from the pelvis to the abdomen. At first, the renal arteries come from the common iliac artery, and when the kidney ascends to higher levels, the abdominal aorta takes over the arterial supply. Presence of accessory renal arteries is due to the failure of lower arteries to degenerate. There are reports on the existence of accessory renal arteries.[7-9] They usually enter the kidney above or below the hilum. Their relations to the nearby structures can vary. Bayramoglu et al reported bilateral additional renal arteries originating from the abdominal aorta and an additional right renal vein accompanying the additional right renal artery.[10] These anomalies were associated with non-rotated kidneys with extrarenal calyces and pelvis. Recent reports describe the presence and distribution of additional renal vessels and their clinical implications.[11,12]

Though there have been reports on abnormal shapes, positions and vascular variations of the kidney, to our knowledge, there are no reports on twisted renal vessels. The variation we are reporting here is peculiar and unique. This twisting of the renal vessels may not be due of the abnormal rotation of the kidney because if that was the case, the ureter would have been twisted as well. There is no embryological explanation for the twisting of the renal vessels around each other. The twisted renal vessels may cause functional disturbances in the kidney. Probably that is the cause for the change in the shape of the kidney and its non-rotation. The kink in the inferior vena cava at the level of the renal vein is also notable. This type of kink might slow the blood flow in the inferior vena cava and might lead to the stagnation of blood and oedema of the lower limbs or thrombosis in the veins below the level of the kink. This case report is of special importance to radiologists and nephrologists. Invasive radiological techniques may fail due to the twisting of the vessels. The knowledge of this variation may also be useful in kidney transplant surgery.

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