

BILATERAL DUPLICATION OF RENAL ARTERY: EMBYOLOGICAL BASIS

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ABSTRACT

Knowledge of the variations of renal vascular anatomy has importance in exploration and treatment of renal trauma, renal transplantation, renal artery embolization, surgery for abdominal aortic aneurysm and conservative or radical renal surgery. The present case shows bilateral duplication of renal artery in 60-year-old male cadaver during routine dissection of abdomen. On right side, the first renal artery was arising from abdominal aorta just below the origin of superior mesenteric artery. The artery was running laterally for a distance of 6 cm and reached the hilum of right kidney. The second renal artery was also taking origin from abdominal aorta 2 cm below the origin of superior mesenteric artery at the level of L1 vertebra, proceeding laterally and also entered the hilum of right kidney. On left side, the first renal artery was taking origin 1.5 cm below the origin of superior mesenteric artery from abdominal aorta while the second renal artery was arising from abdominal aorta at the level of L3 vertebra. Both the arteries were running laterally to enter the hilum of left kidney.

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INTRODUCTION

Renal arteries are a pair of lateral branches from the abdominal aorta arising just below the level of origin of the superior mesenteric artery. Normally, each kidney receives one renal artery. The venous drainage of each kidney is through one renal vein, which drains the blood from the kidney into the inferior vena cava. The accessory renal arteries are seen frequently (1-3). They enter the kidney either above or below the hilum.

Renal artery variations are common in the general population and the frequency of variation shows social, ethnic, and racial differences (4). It is more common in Africans (37%) and Caucasians (35%), and is less common in Hindus (17%). The frequency of extra renal arteries shows variability from 9% to 76% and is generally between 28%–30% in anatomic and cadaver studies (4, 5). Renal artery variations are becoming more important due to the gradual increase in interventional radiological procedures, urological and vascular operations, and renal transplantation (5, 6). Knowledge of the variations of renal vascular anatomy has importance in exploration and treatment of renal trauma, renal transplantation, renal artery embolization, surgery for abdominal aortic aneurysm and conservative or radical renal surgery.

CASE REPORT

The variation was noticed in a 60 year old male cadaver during a routine dissection of the abdomen in the Department of Anatomy, King George's Medical University, Lucknow, Uttar Pradesh. Apart from normal renal artery, an additional artery was supplying the kidney bilaterally. A

careful dissection was done to see their site of origin, course and termination.

On right side, the first renal artery was arising from abdominal aorta just below the origin of superior mesenteric artery. The artery was running laterally for a distance of 6 cm and reached the hilum of right kidney. The second renal artery was also taking origin from abdominal aorta 2 cm below the origin of superior mesenteric artery at the level of L1 vertebra, proceeding laterally and also entered the hilum of right kidney. The length of the artery was 5.5 cm. On left side, the first renal artery was taking origin 1.5 cm below the origin of superior mesenteric artery from abdominal aorta while the second renal artery was arising from abdominal aorta at the level of L3 vertebra. Both the arteries were running laterally to enter the hilum of left kidney. The length of the arteries was 3.2 cm and 4.5 cm respectively (Fig.1). No other anomalies were observed in the posterior abdominal wall.

DISCUSSION

Different origins of renal arteries and frequent variations are explained by the development of mesonephric arteries. These arteries form a vascular net feeding the kidneys, suprarenal glands, and gonads on both sides of the aorta between cervical 6 and lumbar 3 vertebrae, a region known as rete arteriosum urogenitale. Over time, these arteries degenerate, leaving only one mesonephric artery, which undertakes arterial circulation of the kidneys.

Deficiency in the development of mesonephric arteries results in more than one renal artery (7). Main

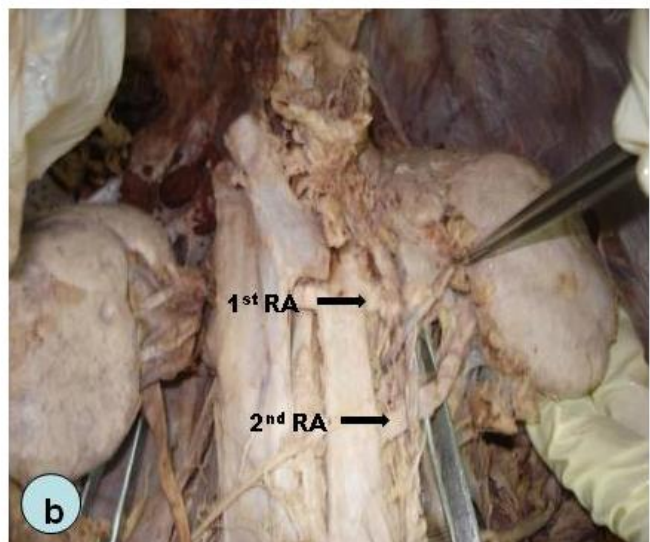
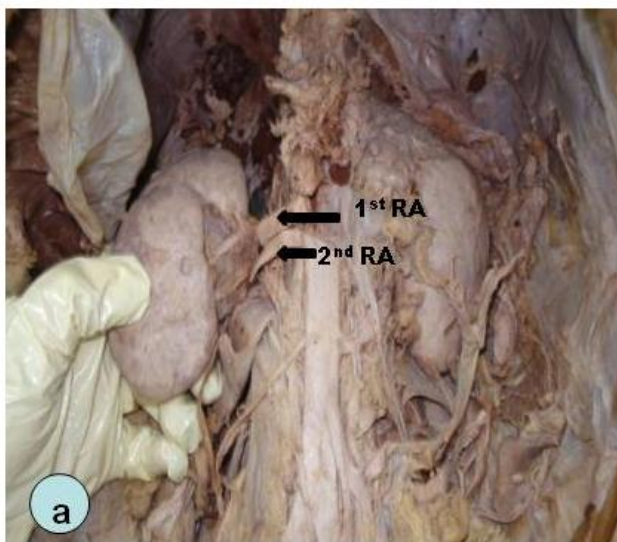
renal artery generally originates from the abdominal aorta, just below the superior mesenteric artery at the level of L1 and L2 vertebrae. With respect to the vertebral column, right main renal artery originates above the left renal artery.

Accessory renal arteries constitute the most common, clinically important vascular variant and are seen in up to one-third of patients. Multiple renal arteries are unilateral in approximately 30% of patients and bilateral in approximately 10%. Accessory renal arteries usually arise from the aorta or iliac arteries anywhere from the level of T11 to the level of L4 vertebra. In rare cases, they can arise from the lower thoracic aorta or from lumbar or mesenteric 2 arteries. Usually, the accessory artery courses into the renal hilum to perfuse the upper or lower renal poles. Accessory vessels to the polar regions are usually smaller than accessory hilar renal arteries, which are typically equal in size to a single renal artery (8).

Rusu (2006) reported bilateral double renal arteries on the right side as superior hilar and inferior hilar renal arteries, and on the left side as superior hilar and inferior polar renal arteries (9). This finding is similar to our case as all these renal arteries emerged from the

abdominal aorta. There are reports of duplication of renal arteries. Bordei et al. (2004) studied renal vascularization and reported 54 cases of double renal arteries supplying one kidney and originating from aorta. Of the 54 cases, six cases were bilateral. In about 28 cases, supplementary renal artery entered the kidney through the hilum, in 16 cases it was inferior polar, in five cases it was superior polar (3). Janschek et al. (2004) reported incidence of multiple arteries to be 20.2% and 19% on right and left sides, respectively (10), however Saldarriaga et al. (2008) reported ninety-seven (24.9%) out of 390 kidneys having additional arteries; 87 (22.3%) had one additional artery and 10 (2.6%) had two additional arteries. The frequency of one additional artery was 43.5% on right side and 56.3% on left side (11). There is discrepancy regarding the side of the additional arteries present; some authors have reported a higher frequency on the left side (2, 3), others reported this variation to be more frequent on the right side (12,13). The presence of double renal arteries increases the complexity of renal transplantation; kidneys with double arterial supply being involved in a higher percentage of transplant failures than kidneys showing no variation (3).

Figure 1: Photograph showing bilateral duplication of renal artery (RA):
a) on right side **b) on left side**



CONCLUSION

The bilateral variation described in the current observation present a unique pattern of congenital renal vascular variants having surgical and radiological importance.

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