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Case Note

Bilateral prehilar multiple branching of renal arteries: A case report and literature review

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Abstract
Proper knowledge of variations of the arteries supplying the kidney is essential not only to the anatomists but also to the surgeons. In the present paper we are reporting a case of bilateral early and multiple branching of the renal arteries. The origin of the 2 renal arteries was normal but soon after their origin they ended by giving rise to multiple branches. Most of these branches entered the kidney through the hilum. However, on both sides, one of the branches (superior polar artery) passed superolaterally to reach the upper pole of the kidney. The superior polar artery also gave rise to the inferior suprarenal artery. Further, related literature review is done and the urological implications of these variations in renal surgeries are discussed.

Key words: renal artery, variations, superior polar artery, multiple branches

A thorough knowledge of the variations of the renal artery has grown in importance with the increasing numbers of renal transplants, vascular reconstructions, and various surgical and radiologic techniques. Normally, renal arteries arise as lateral branches of abdominal aorta at the level of 2nd lumbar vertebra. From their origin the arteries run laterally towards the kidney and enter the hilum between renal vein and renal pelvis. As it runs laterally it gives inferior suprarenal, ureteric and muscular branches. Variations in the origin of the renal arteries and existence of accessory renal arteries are commonly reported. Bilateral early and multiple branching of radial arteries and their unusual course reported in the present paper is a rare variation.

Case Report

During routine dissections for the first-year medical students of Melaka Manipal Medical College, Manipal, we noticed an unusual case of multiple and early branching of renal arteries. This was observed bilaterally in approximately 60-year-old male cadaver. The right and left renal arteries branched as lateral branches of abdominal aorta about an inch below the origin of superior mesenteric artery at the level of 2nd lumbar vertebra. The right renal artery bifurcated about 2cm distal to its origin behind inferior vena cava into upper and lover divisions. The upper division passed laterally towards the kidney and ended slightly proximal to the renal hilum by dividing to 2 branches which entered in to the kidney through its hilum. As the upper division passed laterally it gave a branch (right superior polar artery) which ran superolaterally towards superior renal pole and entered the kidney along the upper part of its medial border. Interestingly this branch also gave origin to inferior suprarenal and a muscular branch to diaphragm. The lower division also ended by dividing in to two branches and each of these branches was further divided into two before entering the kidney through the hilum. Within the renal hilum most of these branches passed between renal vein and renal pelvis except 2, which passed anterior to the renal vein (Fig 1and Fig 2).

The left renal artery bifurcated immediately after its origin into upper and lower divisions. The upper division passed laterally towards the kidney and gave 3 branches which passed anterior to left renal vein and entered the kidney through its hilum. As the upper division passed laterally it gave a branch (left superior polar artery) which ran superolaterally towards superior renal pole and entered the kidney along the upper part of its anterior surface.

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As on the right side this branch also gave origin to inferior suprarenal artery to the left suprarenal gland. However, lower division passed laterally posterior to left renal vein and renal pelvis ended by dividing into two branches which entered the kidney through the posterior aspect of the hilum. On the left side the renal artery branches almost completely surrounded the renal vein and renal pelvis (Fig 1 and Fig 3).

Fig 1: Figure showing the multiple branches (arteries marked *) of the right (RRA) and left (LRA) renal arteries. Also seen are abdominal aorta (AA), right kidney (RK), left kidney (LK), right superior polar artery (RSPA), left superior polar artery (LSPA), right inferior suprarenal artery (RISA), left inferior suprarenal artery (LISA), right suprarenal gland (RSG), left suprarenal gland (LSG), superior mesenteric artery (SMA).

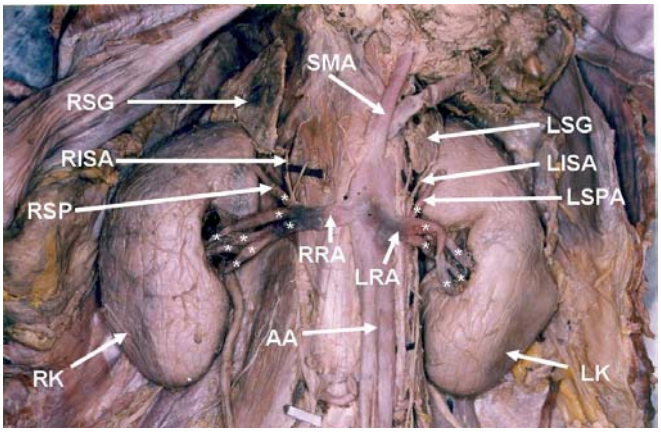


Fig 2: Figure showing the multiple branches (arteries marked *) of the right renal artery (RRA). Also seen are right kidney (RK), right superior polar artery (RSPA), right inferior suprarenal artery (RISA), right suprarenal gland (RSG), renal pelvis (RP).

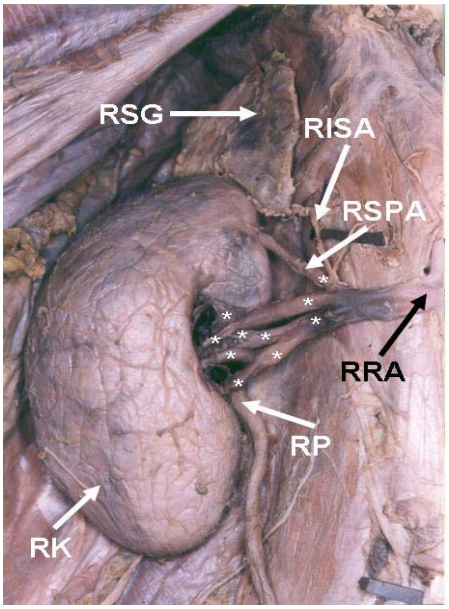
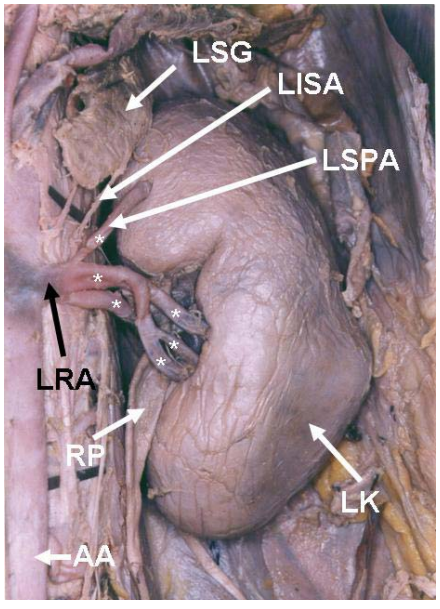


Fig 3: Figure showing the multiple branches (arteries marked *) of the left renal artery (LRA). Also seen are abdominal aorta (AA), left kidney (LK), left superior polar artery (LSPA), left inferior suprarenal artery (LISA), left suprarenal gland (LSG), renal pelvis (RP)



Discussion

Variations in the renal arteries are not uncommon. Many variations of the renal arteries are reported. Dissection of 40 cadavers studied by Dhar and Lal[1] has revealed a single main renal artery on either side in 80% of the specimens. Multiple (accessory) renal arteries in 20% of the specimens with unilateral anomaly (15%) being more commonly encountered than bilateral anomaly (5%). A study of renal vascularization has reported 54 cases of double renal arteries supplying one kidney and originating from the aorta. Of the 54 cases, six cases were bilateral. In about 28 cases the supplementary renal artery entered the kidney through the hilum, in 16 cases it was inferior polar, in 5 cases it was superior polar [2]. In a study conducted on 267 Thai cadavers, following observations regarding renal artery were made: a single hilar artery in 82% of cases; double renal arteries in 17% of cases; and triple renal arteries occurred in 1% [3]. In another study, the renal arterial supply was analyzed in 266 kidneys dissected from 133 fixed adult subjects. The anatomical findings included: 1 hilar artery in 53.3% of the cases, 1 hilar artery with 1 superior pole extra-hilar branch in 14.3%, 2 hilar arteries in 7.9%, 3 hilar arteries in 1.9%, superior polar artery in 6.8%, inferior polar artery in 5.3% and other variations in 8.5%[4]. Accessory renal arteries are found frequently-more often on the left side and occurring in as high as 30-35% of cases in some series. These arteries usually enter the upper or lower poles of the kidney [5].

In addition, many other individual cases of variations of the renal arteries have been reported. A case of supplementary left renal artery arising from the opposite renal artery has been reported by Giavroglou and Kokkinakis [6]. Loukas et al. [7] have reported a case of presence of 3 renal arteries on the right side and 2 on the left. On the right side, one accessory renal artery originated as a common trunk with the inferior mesenteric artery. Whereas, on left side testicular artery branched from the left renal artery. A case of occurrence of bilateral additional renal arteries originating from the abdominal aorta has been reported by Bayramoglu et al. [8]. Turgut et al. [9] have observed 2 polar arteries on the left kidney besides the normal renal artery. The upper polar artery arising just at the beginning of left renal artery and the lower one arising directly from the lateral wall of abdominal aorta. Singh et al[5] have reported a case of presence of bilateral accessory renal arteries which are giving origin to both the right and left gonadal arteries respectively.

By the above literature review it is quite evident that most of the reported variations of the renal arteries are either their abnormal origin or the presence of accessory arteries. A case of bilateral, early, prehilar, multiple branching of the renal artery and their variant course is being reported for the first time. The proper knowledge of these variant renal artery branches or accessory renal arteries and their course and relationship with the renal pelvis and ureter are clinically very essential. It has been said that arteries in front of or behind the renal pelvis are the cause of ureteropelvic function obstruction in 15-52% of cases and their close relationship with the upper urinary tract can complicate the procedure of endopyelotomy [10]. There are some reports of such abnormal course of accessory renal arteries. Bordei et al. [2] have reported 6 cases of retroureteral passage of the supplementary renal artery. In a case reported by Singh et al. [5], the accessory renal arteries showed dual relationship with the ureters. A case of bilateral additional renal arteries passing posterior to ureter with a close relationship to the ureteropelvic junction is also reported [8]. In the present case also we have noted the multiple and unusual relationships between the prehilar branches of renal arteries and renal vein and renal pelvis. As far as the course of these branches concerned a more unusual yet interesting observation done in the present case is bilateral superior polar arteries entering directly the renal cortex (not through the hilum). Such obliquely running arteries become important clinically. Beyer and Daily [11] have reported a case of two renal arteries on the right side and one supplying the upper pole (superior polar) being more vertical in trajectory than the usual main renal artery (as reported in the present case) causing upper pole infarction. Familiarity about the possible variations in the renal arterial pattern is especially important for the personnel dealing with kidney retrieval and transplantation, various endourologic procedures and numerous interventional techniques. In such situations, it is the comprehensive knowledge of the renal arterial pattern which remains as the key issue in determining the technical feasibility of surgical interventions as well as the post operative management. In preparation for surgical interventions like, living renal donation, vascular reconstruction, renovascular hypertension, or radical nephrectomy, preoperative renal imaging is essential. In addition, the operative techniques with attention to the prehilar multiple branches of renal arteries should also be considered. Our observations in the present case will supplement the knowledge of variations in the renal arteries, which should be quite useful in renal surgeries.

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