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Case Report

An unusual case of unilateral additional right renal artery and vein

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ABSTRACT

Proper knowledge of variations of the vessels of the kidney is essential to the radiologists and surgeons. One such variation was observed in a 65-year-old male cadaver at AIMST University, Kedah, Malaysia. The dissection of the abdomen revealed an additional renal artery and an additional renal vein on the right side. In addition to the normal right renal artery, an additional renal artery branched from the ventral side of abdominal aorta and passed laterally to enter into the kidney through the lower part of its hilum. The additional right renal vein emerged from the lowermost end of the hilum, passed medially below the additional renal artery to end in the inferior vena cava below the opening of normal right renal vein. Further, related literature review is done and the urological implications of these variations in renal surgeries are discussed. © **IJAV. 2010; 3: 9–11.**

Key words [renal vein variation] [renal artery variation] [additional renal vein] [additional renal artery] [additional ventral branch of aorta]

Introduction

Usually, the right kidney is supplied by one renal artery, which arises as one of the lateral branches of abdominal aorta at the level of 2nd lumbar vertebra. The right renal artery passes horizontally anterior to right crus of diaphragm and behind the inferior vena cava to reach the hilum. Before reaching the hilum of the kidney, the artery divides into four or five branches. The right kidney is normally drained by one renal vein which lies in front of renal artery and passes medially to end in the inferior vena cava (IVC) [1]. Unusual vascular pattern of the kidneys are the most often encountered variations among the renal morphological variations. Variant vascular pattern have been associated with hilum of the kidney and those entering and leaving the kidney outside the hilum. Most of these variations remain undiscovered until being noticed during any surgical procedure or venography; or to be found by the forensic pathologist during autopsy. When identified, documentation of such congenital vessel variations is important as it holds many surgical and therapeutic implications. A rare case where the right kidney was supplied by an additional renal artery arising from the ventral side of the aorta, and an additional renal vein draining into IVC is reported here.

Case Report

The renal arteriovenous variation was observed in about 65-year-old male cadaver during the routine dissection for undergraduate medical students at Department of Anatomy, Faculty of Medicine, AIMST University, Malaysia. The specimen showed a normal right renal artery which branched from the lateral side of the aorta and then passed horizontally anterior to the right crus of diaphragm and behind the inferior vena cava to reach the hilum. Before reaching the hilum of the kidney, the artery divided into 3 branches. The additional renal artery branched from the ventral surface of the abdominal aorta slightly above the level of the normal renal artery. It then took an abrupt right turn (kink) and passed downwards and to the right crossing the normal right renal artery from front to reach the lover part of the hilum immediately above the additional renal vein. The normal right renal vein emerged from the right kidney in front of the rest of the structure at the hilum and drained into IVC. The additional right renal vein emerged from the lowermost end of the hilum passed medially below the additional renal artery to end in the IVC about 4 cm below the opening of normal right renal vein. The renal vessels on the left side were as usual (Figures 1, 2 and 3).

Discussion

It is widely accepted that renal vessels, especially arteries exhibit a high degree of variations. Many studies have been carried out and cases are reported about these variations. Kaneko et al. have studied 190 cadavers and reported the cases of additional renal artery emerging below the inferior mesenteric artery in 2.4% of cadavers on the right side and 1.8% on the left [2]. An angiographic evaluation of 855 cases has showed renal artery variations like multiple arteries in 24%, bilateral multiple arteries

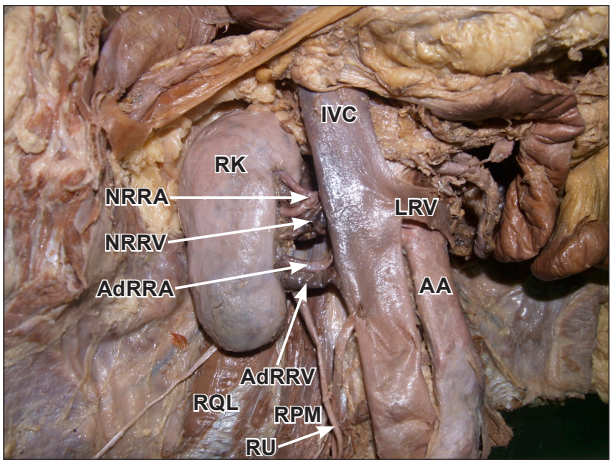

Figure 1. Dissection of the abdomen illustrating the additional renal vessels. It can be noted that additional right renal vein passes below the additional right renal artery and opens in the inferior vena cava. *(**RK:** right kidney; **NRRA:** normal right renal artery; **AdRRA:** additional right renal artery; **NRRV:** normal right renal vein; **AdRRV:** additional right renal vein; **IVC:** inferior vena cava; **RQL:** right quadratus lumborum; **RPM:** right psoas major; **RU:** right ureter; **AA:** abdominal aorta; **LRV:** left renal vein)*

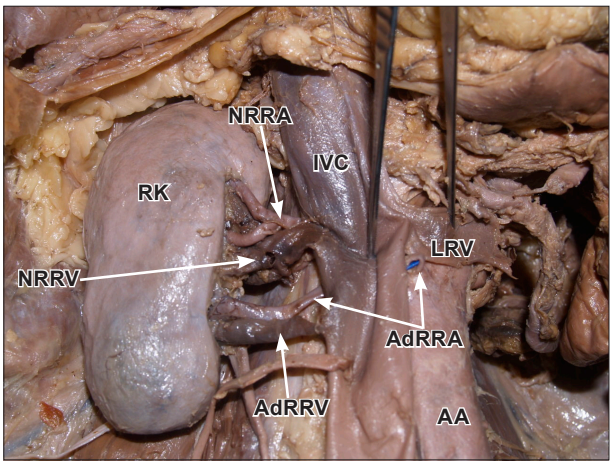

Figure 2. Dissection of the abdomen illustrating the additional renal vessels. It can be noted that additional right renal vein passes below the additional right renal artery and opens in the inferior vena cava. Also seen is the origin of the additional right renal artery from the abdominal aorta and the sharp kink formed by it at is origin. *(**RK:** right kidney; **NRRA:** normal right renal artery; **AdRRA:** additional right renal artery; **NRRV:** normal right renal vein; **AdRRV:** additional right renal vein; **IVC:** inferior vena cava; **AA:** abdominal aorta; **LRV:** left renal vein)*

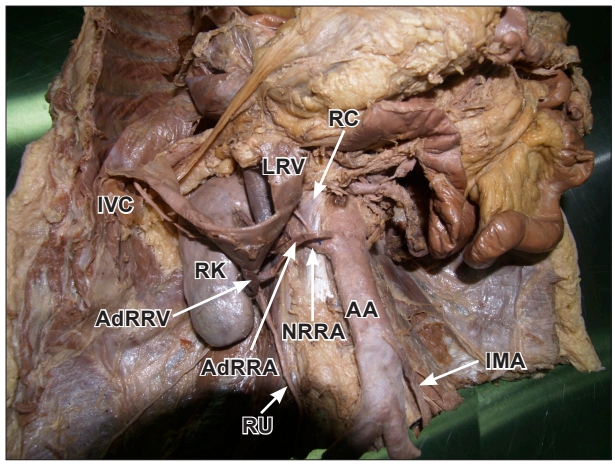

Figure 3. Dissection of the abdomen illustrating the additional renal vessels. Inferior vena cava has been lifted and pushed to the side to expose the origin of additional right renal artery from the abdominal aorta. Also seen is the origin of the normal right renal artery from the abdominal aorta. *(**RK:** right kidney; **AA:** abdominal aorta; **NRRA:** normal right renal artery; **AdRRA:** additional right renal artery; **AdRRV:** additional right renal vein; **RU:** right ureter; **LRV:** left renal vein; **IMA:** inferior mesenteric artery; **IVC:** inferior vena cava; **RC:** right crus of diaphragm)*

in 5% and early division in 8% of the cases. Additional renal arteries on the right side were found in 16% and on the left side in 13% of cases. Of all the extra renal arteries, the percentage of accessory and aberrant renal arteries were 49% and 51%, respectively. However, in about 74% of cases renal arteries were normal [3]. Dissection of 40 cadavers studied by Dhar and Lal 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 cases (15%) being more commonly encountered than bilateral cases (5%) [4]. A study of renal vessels in about 90 fetuses has shown a single hilar artery in 75% of the cases, double hilar arteries in 11.1%, an inferior polar artery in 10.5%, and a superior polar artery in 3.3% of specimens studied. It is also interesting to know that these anatomical variations were observed more frequently among male fetuses and on the right side [5]. In another study, the renal arterial supply was analyzed in 266 kidneys dissected from 133 fixed adult subjects. The anatomical findings were 1 hilar artery in 53.3%, 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% of cases [6]. Satyapal et al. have analyzed 1244 pairs of kidneys and reported additional renal arteries on right side in 18.6% and on left side in about 27.6% of cases [7]. From the available reports it can be said that the incidences of variations among the renal arteries is about 20-25%. Almost the same percentage (27.7%) of incidences of additional renal arteries is reported [8]. Many peculiar cases of additional renal arteries have been reported. Bilateral triple renal arteries were reported by Pestemalci et al. [9]. Three multiple right renal arteries branched off from the abdominal aorta at different levels to supply the right kidney [10]. Many cases of bilateral double renal arteries originating from the lateral aspects of the abdominal aorta were also reported [11,12,13,14]. Another interesting case was reported by Tanyeli et al., where they found 2 right renal hilar arteries and superior renal hilar artery crossed the inferior renal hilar artery as they passed towards the kidney [15]. In the present case also we can see similar crossing of the 2 arteries. In another case, an accessory right renal artery originated

as a common trunk with the inferior mesenteric artery [16].

The variations among the renal veins are not as common as arteries. Very few cases of additional renal veins have been reported. The incidents of additional renal veins reported to be 3.3% on right side and 2.6% on left [8]. Satyapal conducted a study to determine the site of entry of renal veins into the IVC. He has reported that left vein entered IVC higher than right in 54%, lower in 36% and opposite each other in about 10% of cases [17]. It can be recalled that in the present case the normal right renal vein opened into IVC opposite the left renal vein and the accessory right renal vein about 4 cm below the normal. Some other renal vein variations reported are the retroaortic left renal vein opening in to the left common iliac vein, a circumaortic venous ring and a retro-aortic bifid left renal vein [18,19]. In fact it is even suggested that the incidents of additional renal veins are much less, that is about 0.4% than what is mentioned in standard text books which is about 0.8 to 6% [20]. From above literature review it is evident that though the cases of accessory renal arteries are common the incidents of accessory renal veins are rare. Further, the case of both the variations occurring together is not reported so far.

Knowledge of the variations of the renal vessels has grown in importance with increasing numbers of renal transplants, vascular reconstructions and various surgical and radiological techniques being performed in recent years [5,8,9]. It also facilitates a safe approach to the kidneys in trauma management [2]. A significant surgical and radiological difficulty may be encountered in the presence of undiagnosed variations of the renal arteries preoperatively. In selected cases, a conventional arteriography or CT angiography can be of great help in reducing unexpected problems and improving the outcome [10]. In the majority of such situations, it is the comprehensive knowledge of the renal arterial pattern that remains the key issue in determining the technical feasibility of surgical interventions as well as the post-operative management [4]. The likelihood of the additional renal vessels should be kept in mind when a non-invasive diagnostic search is performed for renal artery stenosis or when renal surgery related to renal arteries is performed [3]. In addition to the surgical importance, some of these variations might have some clinical implications as in the present case where the sharp kink formed by the additional artery might affect the renal blood flow. As far as renal vein variations are concerned, most of them remain unnoticed until discovered during venography, operation or autopsy as they are clinically silent. However, to a transplant surgeon, morphology acquires special significance, since variations influence technical feasibility of the operation [20]. In addition to other variations, the level of entry of renal veins into the IVC is also important as these findings are clinically important for the angiographer, catheter design, and planning porto-renal shunt procedures [17]. During such procedures, cases similar to the one reported here (double renal veins and both opening into IVC at different points) also must be kept in mind.

We would like to conclude by stating that, our findings in above case will add to the long list of variety of variations among the renal vessels. Knowledge of possible variations among renal vessels is essential for radiologists and surgeons.

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