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Research Paper

Double right renal vein: clinical and surgical implications and review of the literature

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Abstract

Context: Variations in renal vascular morphology are relatively common and involve both the renal arteries and the renal veins. Presence of supernumerary vessels is the variation most frequently encountered. Knowledge of such findings is valuable for urologists with regard to kidney transplantation, nephrectomy, vascular anastomosis, selective catheterization and many other surgical procedures on the kidneys.
Objective: To report on a case of duplication of the right renal vein and its clinical and surgical implications.
Case report: In one dissected specimen from a male cadaver, the presence of two right renal veins parallel to each other was observed in a position anteroinferior to the right renal artery. One vein emerged from the upper portion of the renal hilum, while the other emerged from the lower portion of the hilum. The two veins drained separately into the inferior vena cava, and neither of them received any tributaries.
Conclusion: Knowledge of these vascular variations is important for urologists, vascular surgeons and radiologists, given that performing angiography prior to surgical interventions in the retroperitoneal space avoids complications, especially with regard to kidney transplantation.

Keywords: *Anatomical Variations; Renal Veins; Inferior Vena Cava; Kidney Transplantation; Accessory Renal Vessels.*

1. Introduction

The renal veins occur bilaterally and drain each of the kidneys into the inferior vena cava. Because the right kidney is closer to the interior vena cava, the right renal vein is generally shorter and rarely receives tributaries. On the other hand, the left renal vein, which is longer, may receive several tributaries [1], [2].
Variations in the origin, path and termination of the renal veins, along with vascular malformations that are found in the renal hilum involving both arteries and veins, result mainly from errors of embryonic development [3], [4].
Several vascular anatomical variations in the renal hilum have been studied. The appearance of supernumerary vessels is the variation most frequently encountered among the renal morphological variations [1], [2], [5-8].
Knowledge of these variations, along with any other variations, is clinically important, because it allows surgeons to make better preoperative evaluations and thus minimize the risk of surgical complications [9]. The present study had the aim of reporting on a case of duplication of the right renal vein and the clinical and surgical implications of this anatomical variation.

2. Case report

In one dissected specimen from a male cadaver of dark skin color, with apparent age between 50 and 55 years, belonging to the Anatomy Laboratory of Tiradentes University, the presence of two right renal veins parallel to each other was observed in a position anteroinferior to the renal artery. These two veins drained separately into the inferior vena cava without receiving tributaries. The first of these veins emerged from the upper third of the renal hilum, close to the entry point of the right renal artery, and the second of these veins emerged from the lower third of the hilum (Fig. 1). On emerging from the renal hilum, the upper renal vein (which was of larger diameter) took an oblique anteroinferior direction, underwent a constriction followed by dilatation, probably due to slight compression of one of the segmental renal arteries, and emptied into the inferior vena cava, forming an acute angle with this (Fig. 2). Meanwhile, on emerging from the renal hilum, the inferior renal vein (which was smaller in diameter) took an ascending direction and then made a curve of approximately 120° downwards and emptied into the inferior vena cava, forming approximately a right angle at a posteroinferior position in relation to the upper renal vein (Fig. 1,2).

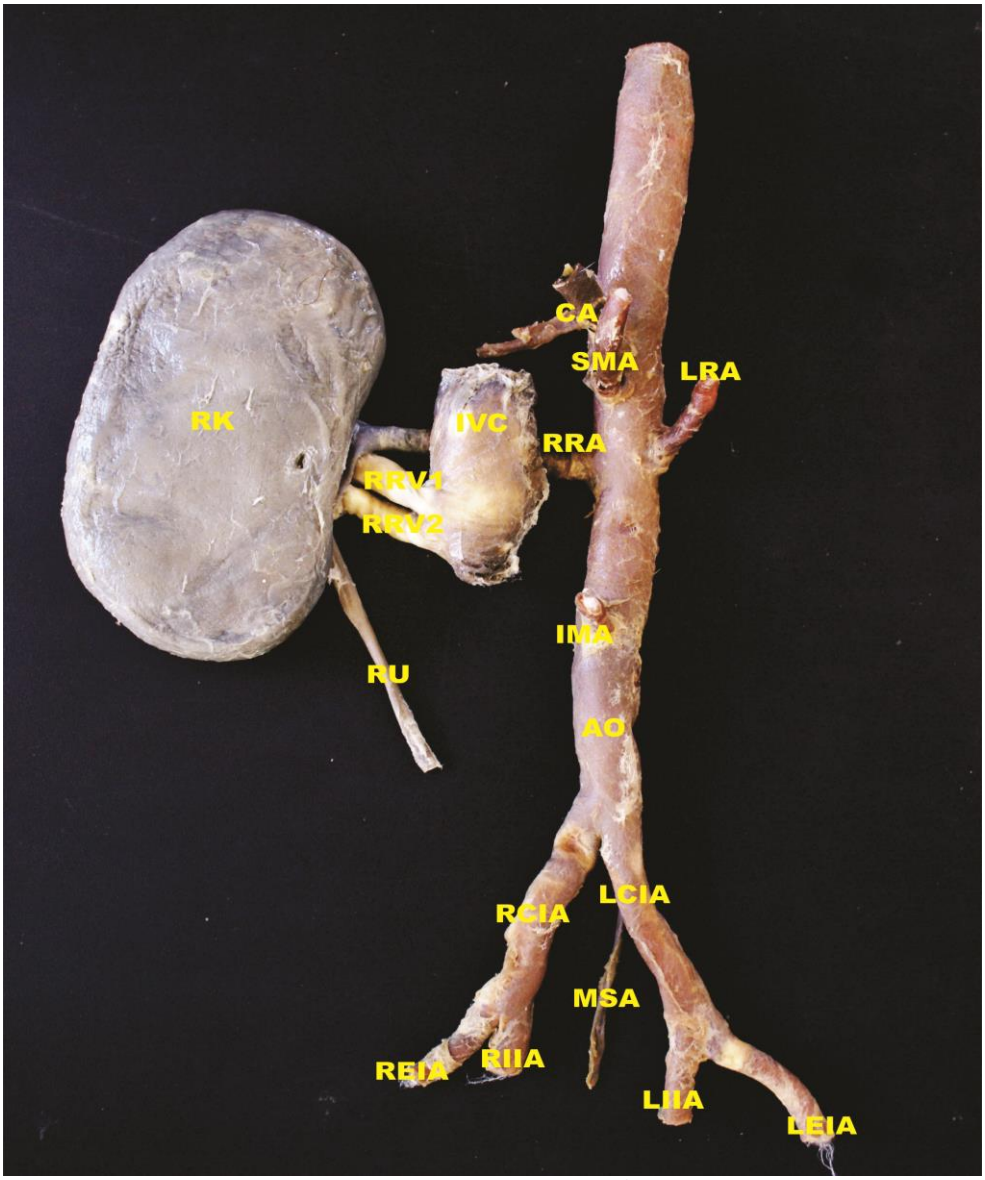


Fig. 1: Double Renal Vein Draining Into the Inferior Vena Cava

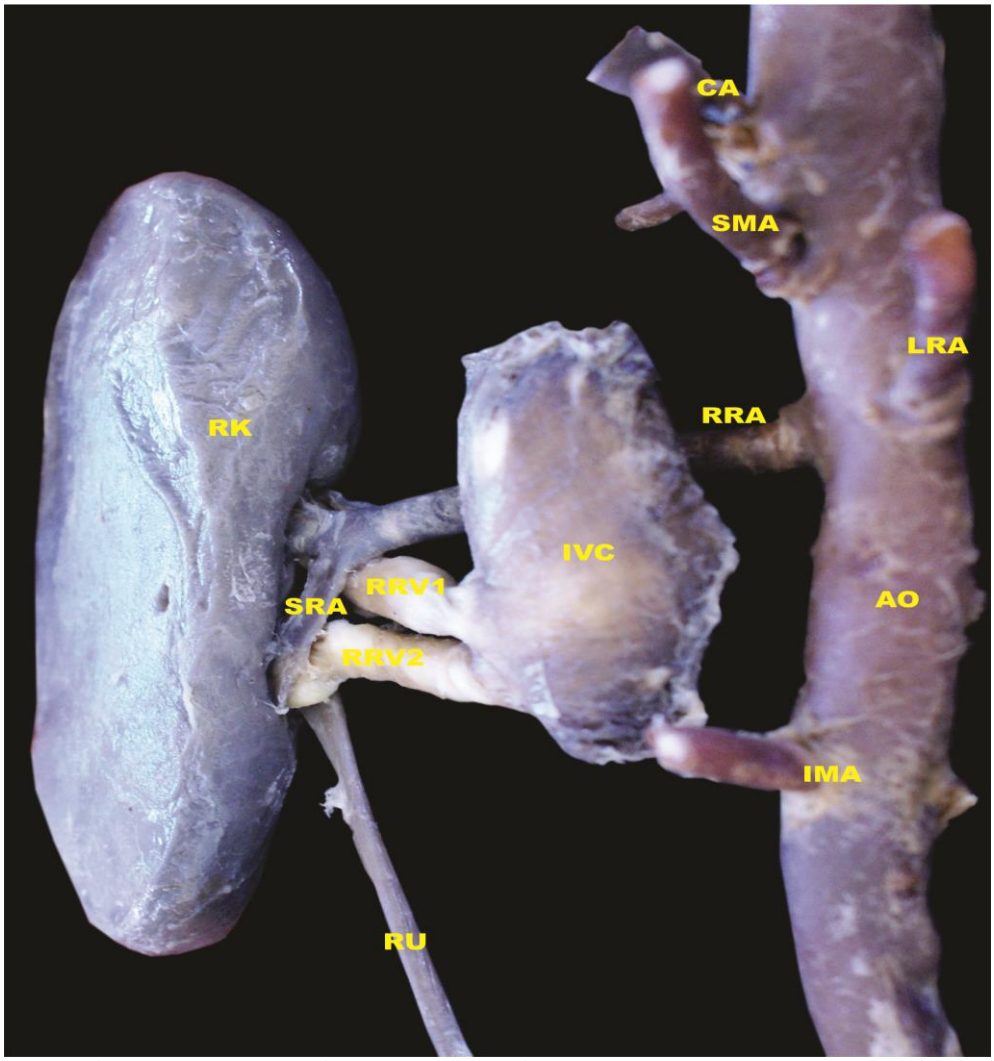


Fig. 2: Direction of the Double Renal Veins, from Their Emergence from the Renal Hilum to Their Outlet in the Inferior Vena Cava

3. Discussion

Clear knowledge of the embryology of the renal vein and inferior vena cava system is very important given its high complexity, and remains the best way to understand the variations and anomalies of this system. The retroperitoneal venous system develops from three parallel fetal venous systems: posterior cardinal, subcardinal and supracardinal. Anastomosis between the subcardinal and supracardinal systems forms the renal vein segment, and the supracardinal system gives rise to the postrenal segment of the inferior vena cava, below the diaphragm. This receives two renal veins from each side (one ventral and the other dorsal) and, during the course of the 8th week of fetal life. The two veins merge to form a single vein on each side. An error of fusion of these two vessels, thus causing their persistence, may result in bilateral or unilateral duplication of these vessels [10].

Occurrences of multiple renal veins are relatively common, and several authors have reported large numbers of venous variations resulting from embryonic developmental errors [1], [5], [11-13]. According to Kaneko, Kobayashi and Okada [14], the renal veins present fewer variations than do the renal arteries, and multiple renal veins are more common on the right side than on the left-sid [8].

In our study, multiplicity of the renal veins was found on the right side. One emerged from the upper third and the other from the lower third of the renal hilum. The upper renal vein emptied into the inferior vena cava forming an acute angle, while the lower renal vein formed a right angle with the inferior vena cava. Similar findings were reported by Verma et al [6].

According to Satyapal [5], this angle was usually 60° ± 17° on the right side. This author stated that large variations in this measurement would not be surprising, given that the kidneys are usually regarded as “floating viscera” that vary in the position with posture and with respiratory movements. Moreover, in vivo measurements differ from those made in cadavers.

In the present study, both of the renal veins emptied into the inferior vena cava without having received any tributaries, and this has also been reported by other authors [1], [15-17]. In most cases, these variations of duplication of the renal veins are clinically silent and remain unnoticed until they are discovered in the course of venography, operations or

autopsy [18]. For kidney transplantation surgeons, the morphology of the renal vein takes on special significance, given that its variations influence the technical viability of the operation and may restrict mobilization of the vein [7,19]. Nonetheless. Some anatomic variations in the renal veins may be correlated with clinical symptoms, as is the case of pain in the pelvic varices or varicocele. Furthermore, this multiplicity is more common in women than in men, as demonstrated by Arslan et al., Karazincir et al. and Koc et al [20-22]., Therefore, description of the anatomic variations of the renal veins is necessary with regard to investigating the effects of these variations on hemodynamics and renal function, particularly in cases of surgical interventions in the retroperitoneal space [2], [23].

4. Conclusion

Detailed anatomical knowledge of duplication of the renal veins and their main anomalies is extremely important for radiologists, vascular surgeons and urologists, since it provides guidance that will serve to prevent complications that might occur both in endovascular procedures and in surgery involving retroperitoneal access, especially given the increasing frequency of kidney transplantation surgery.

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Legends of figures

Fig. 1: Double renal vein draining into the inferior vena cava
AA – Aortic artery
RRA – Right renal artery
LRA – Left renal artery
RK – Right kidney
SMA – Superior mesenteric artery
IMA – Inferior mesenteric artery
CA – Celiac artery
IVC – Inferior vena cava
RRV1 – Right renal vein 1
RRV2 – Right renal vein 2
RCIA – Right common iliac artery
LCIA – Left common iliac artery
RIIA – Right internal iliac artery
LIIA – Left internal iliac artery
REIA – Right external iliac artery
LEIA – Left external iliac artery
MSA – Median sacral artery
RU – Right ureter
Fig. 2: Direction of the double renal veins, from their emergence from the renal hilum to their outlet in the inferior vena cava
AA – Aortic artery
RRA – Right renal artery
LRA – Left renal artery
RK – Right kidney
SMA – Superior mesenteric artery
IMA – Inferior mesenteric artery
CA – Celiac artery
IVC – Inferior vena cava
RRV1 – Right renal vein 1
RRV2 – Right renal vein 2
RU – Right ureter
RSRA – Right segmental renal artery