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Case Report

BILATERAL MULTIPLE RENAL VASCULAR VARIATIONS AND RIGHT SIDED BIFID URETER: A CASE REPORT

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ABSTRACT

Renal blood supply presents a large degree of variations. In the present case there was existence of bilateral variations in renal blood supply along with right sided bifid ureter. During routine cadaveric dissection in a middle aged male cadaver we found two renal veins draining right kidney and a bifurcating single renal vein on left side. On both sides one polar artery arising from main renal artery going to upper pole of kidney and left side accessory renal artery originating from abdominal aorta and giving origin to left testicular artery were observed. There is bifid ureter on the right side. The knowledge of renal vascular anatomy and its variations are very much essential in case of renal transplantation, renal surgeries, uroradiology, gonadal color Doppler imaging, in abdominal aortic aneurysmal and gonadal surgeries.

KEY WORDS: Renal Blood Supply, Renal Artery Variations, Accessory Renal Artery, Aortic Aneurism.

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INTRODUCTION

The renal arteries are large, paired arteries which take origin from the lateral aspect of aorta at the level of upper part of second lumbar vertebra little below the origin of superior mesenteric artery. The left renal artery is usually little higher than right one and passes posterior to left renal vein to enter left kidney. On each side near the hilum of the kidney, each renal artery divides into anterior and posterior branches, which in turn divide into a number of segmental arteries supplying the different renal segments. The presence of unusual branching patterns of the renal arteries is not uncommon. In 70% of cases there is a single renal artery supplying each kidney [1].

Renal arteries exhibit high degree of variations. Most of these variations remain undiscovered until being noticed during a surgical procedure or they are found by forensic pathologists during

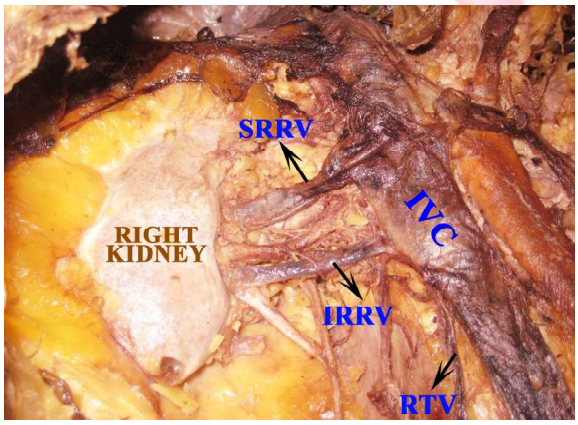
autopsy. About 30% of the population has accessory renal arteries. Renal arteries arise from the abdominal aorta below the origin of the superior mesenteric artery [2].

The venous drainage of each kidney is through a single renal vein, which drains blood from kidney into the inferior vena cava. The left renal vein also receives left suprarenal and gonadal veins. Since the inferior vena cava is situated to the right of aorta, the left renal vein is longer than the right one. A variant expression as an additional renal vein with a separate drainage into the inferior vena cava (IVC) was reported in literature [3]. A higher frequency of an additional renal vein on the right side (7–38%) when compared to left side (1–3%) was reported [3]. The complexity of the embryological development of the left renal vein determines the presence of variable expressions such as a circumaortic course or renal collar, wherein the renal vein emits two branches as it approaches the aorta, one running in front and the other one behind it, that flow separately into the IVC [3].

Each kidney is drained by single ureter, which is the continuation of renal pelvis from the lower pole of kidney. Duplication of ureter might be complete or incomplete. Incomplete duplication of ureter is known as bifid ureter. According to recent studies of Russel et al (2000) on an average, 3% excretory urograms show ureteral duplication on routine examination. Presence of bifid ureter is often seen to be associated with congenital hydronephrosis (4).

CASE REPORT:

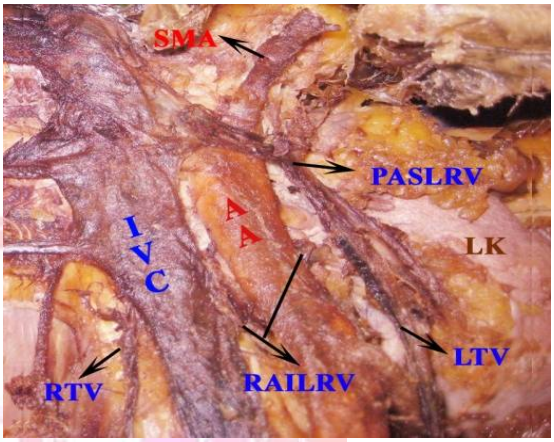
Fig. 1: Right Kidney with 2 Renal Veins.



During routine cadaveric dissection in middle aged male cadaver the following variations were observed in renal vein, renal artery and ureter.

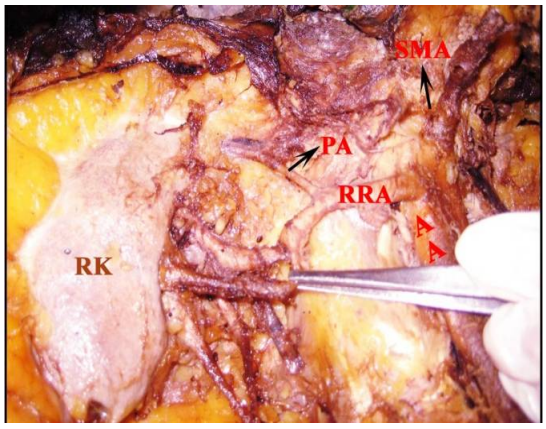
Right Renal Vein (RRV): (Fig. 1) There are two renal veins draining the right kidney as superior and inferior right renal veins (SRRV, IRRV) emerging separately from the hilum,1.0 cm apart, each measuring about 4 cm in length and draining separately into the IVC at a distance of 1.5 cm. Right testicular vein (RTV) is draining in to inferior vena cava (IVC).

Fig. 2: Left Kidney with bifurcation of Left Renal Vein.



Left Renal Vein (LRV): (Fig. 2) Single renal vein draining the left kidney bifurcated into preaortic and retro aortic renal veins. The one which is coursing anterior to the abdominal aorta, below the origin of superior mesenteric artery is measuring 6 cm in length, and drained into IVC opposite to SRRV. Left Supra renal and left testicular veins drained into pre aortic superior left renal vein (PASLRV). Another vein coursing posterior to the abdominal aorta drained into IVC as Retro Aortic Inferior Left Renal Vein (RAILRV) 2 cm below the PASLRV.

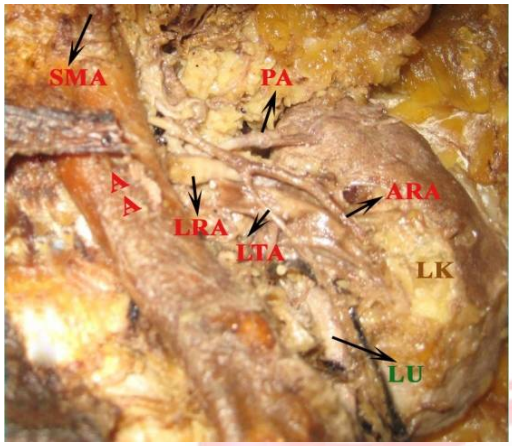
Fig. 3: Right Kidney Polar Aberrant Artery.



Right Renal Artery (RRA): (Fig. 3) Originated just below the superior mesenteric artery on right lateral aspect of the abdominal aorta (AA). It

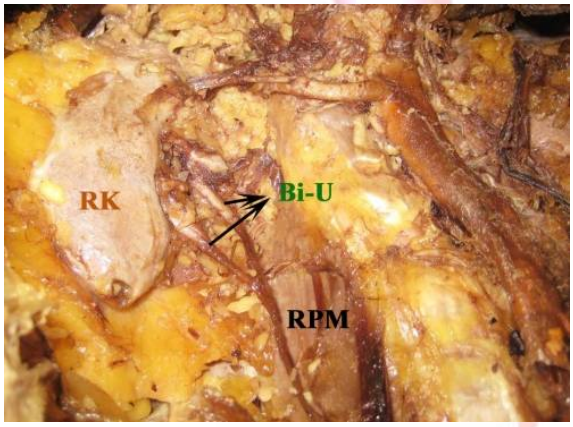
ran forwards beneath the IVC crossing right crus of diaphragm giving a polar aberrant artery (PA) to the upper pole. It finally divided into anterior and posterior divisions to supply the kidney.

Fig. 4: Left Kidney Polar Aberrant Artery and Accessory Renal Artery.



Left Renal Artery (LRA): (Fig. 4) Originated from abdominal aorta below the superior mesenteric artery on the left lateral aspect at a lower level than the right renal artery. It ran forwards crossing left crus of diaphragm, gave a polar aberrant artery (PA) to the upper pole and finally divided into anterior and posterior divisions to supply the kidney. There is an accessory renal artery (ARA) arising from abdominal aorta above the main renal artery which gave left testicular artery (LTA).

Fig. 5: Bifid Right Ureter.

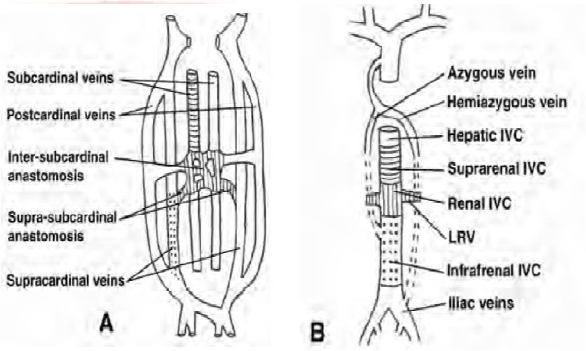


Right Ureter: (Fig. 5) Bifid ureter (Bi-U) was found on the right side. The ureter had two limbs and both the limbs joined at about a distance of 3 cm from the renal hilum descending over right psoas major muscle (RPM).The two limbs of this ureter came as separate entities from the hilum of kidney. The pelvis of the upper limb had its exit at the upper end of the hilum and that of the lower limb at the lower limit of the hilum. The opening of the ureter into the bladder did not show any abnormality.

DISCUSSION

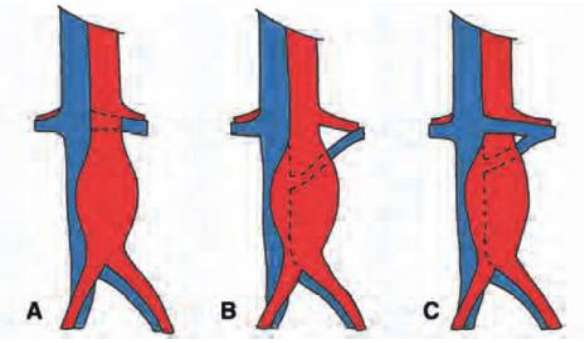
Multiple or supernumerary renal veins on right side with an incidence of 15 - 30 % was reported in literature [5]. Errors in the fusion of branches to the dorsal mesonephros derived from the right post cardinal vein or dorsal-medial branches of the right supra cardinal vein or ventral branches of the right sub cardinal vein during embryogenesis can cause renal venous anomalies (Fig. 6).

Fig. 6: Embryologic derivation of IVC from 6-8 Weeks of Gestation (A) to the adult (B). (Reproduced from Roberto Himenex and Francisco Morant [5].



Left side circum aortic renal vein, because of presence of pre-aortic superior left renal vein (PASLRV) and retro-aortic inferior left renal vein (RAILRV) was reported with an incidence of 1.5 – 8.7 % [5]. It is due to the persistence of the left sub-supra cardinal anastomosis and the left supra cardinal vein along with pre and retro aortic inter sub cardinal anastomosis (Fig.7).

Fig. 6: Left Renal Vein Anomalies. A. Retro Aortic Left Renal Vein Type I. B. Retro Aortic Left Renal Vein Type II. C. Circum Aortic Left Renal Vein. (Reproduced from Roberto Himenex and Francisco Morant [5].



The renal vascular variations are usually asymptomatic. They may lead to thrombosis or renal hypertension. They may mislead interpretation of abdominal imaging like CT

scanning, cause technical difficulties in diagnostic or therapeutic angiography. Knowledge of renal vascular variations facilitates interpretation of abdominal imaging, performing endovascular techniques and retro peritoneal surgeries.

Polar (Aberrant) arteries originate from main renal artery on the right and left sides with an incidence of 24 - 30 %. Accessory Hilar (Junctional) artery originating from abdominal aorta above the main renal artery on the left side from which testicular artery of that side has emerged was reported with an incidence of 5 – 6 %. Developmentally both aberrant and accessory renal arteries were regarded as persistent embryonic lateral splanchnic arteries. Mesonephric and Metanephric arteries persist to supply upper and lower poles [1,2,5].

Accessory renal arteries are end arteries and if damaged the part of kidney supplied by them is likely to become ischemic. Compression of ureter results in hydronephrosis. Compression of adjacent vessels supplying kidney causes renal vascular hypertension, proteinuria and albuminuria [5].

3 % incidence of bifid ureter was reported in literature. This occurs because of pre mature division of the ureteric bud. Patients with bifid pelvis and bifid ureter are more likely to develop urinary infection and calculi which were diagnosed using plain X-ray KUB and Retrograde pyelography [4].

CONCLUSION

A deeper understanding of the urogenital vascular variations and their special relations to adjacent vessels is especially significant in avoiding the complications in clinical diagnostic and surgical procedures and in recognizing the causes of urinary and genital disorders.

Conflicts of Interests: **None**

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