



Case Report

## **Bilateral Accessory Renal Arteries, Additional Right Renal Vein and Retroaortic Left Renal Vein- A Case Report**

Subhra Mandal<sup>1\*</sup>, Prabir Mandal<sup>2</sup>, Ranjan Basu<sup>3</sup>

<sup>1</sup>Assistant Professor, Dept. of Anatomy, Malda Medical College, Malda, West Bengal

<sup>2</sup>PG Resident in DNB (Physical Medicine), S.N.P. Hospital, Kolkata, West Bengal

<sup>3</sup>PG Resident in MD (Microbiology), GSL Medical College, Rajahmundry, Andhra Pradesh

\*Correspondence Email: drsuvramandal@gmail.com

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### **ABSTRACT**

**INTRODUCTION-** A routine cadaveric dissection, at Department of Anatomy, Malda Medical College, in an adult male aged 60 years revealed a rare anomaly of renal vessels.

**CASE PARTICULARS -** The anomaly consisted of bilateral additional renal arteries originating from abdominal aorta, an additional right renal vein and retro aortic left renal vein. Bilaterally, renal arteries were seen entering through the hilum, maintaining the usual relation i.e., from before backwards- renal vein, renal artery and pelvis of ureter. But on both sides, additional renal arteries were most anteriorly placed at the hilum and they gave early segmental branches before entering the kidneys. Other significant anomaly on right side was the presence of two renal veins at the hilum of right kidney, both draining separately into inferior vena cava via two separate openings one above the other. On the left side, though a single left renal vein received its normal tributaries, but it drained into the inferior vena cava after passing behind the abdominal aorta.

**EMBRYOLOGICAL EXPLANATION -** It has been speculated that the additional right renal vein was the persistent communication between the developing mesonephros and right subcardinal vein at 22mm.CRL of embryo. Also, the retroaortic left renal vein may be due to persistent retroaortic anastomosis during development.

**CONCLUSION -** Such vascular anomalies are of immense importance in various renal surgeries. The knowledge of these variations could help the clinician in its prior recognition and due protection accordingly during renal surgeries. An accessory renal artery may be the only source of blood supply to a renal segment. It may press upon the ureter and cause obstruction, leading to hydronephrosis.

**KEY WORDS:** Accessory renal artery, Additional renal vein, Retroaortic renal vein.

### **INTRODUCTION**

Variations in the number and arrangements of renal vessels are common. Anomalous renal arteries are said to occur more frequently than anomalies of any

other large vessels (Gillaspie, Miller and Baskin).<sup>(1)</sup> In an extensive study, Pick and Anson<sup>(2)</sup> found that 40.5% of all kidneys examined had more than two vessels that are more than a single artery and a single

vein. For most part of the body, variations or anomalies of veins are far more frequent than those of arteries, but this is not true of the vascular pedicle of the kidney. Anomalies of renal arteries are more common than are anomalous renal veins. Gillaspie and Co-workers; <sup>(1)</sup> Pick and Anson <sup>(2)</sup> found supernumerary arteries in 32.25% of kidneys but super numerary veins in only 14.4%.

Our study is to explain the embryological basis of these anomalies and to utilize that knowledge during renal surgeries.

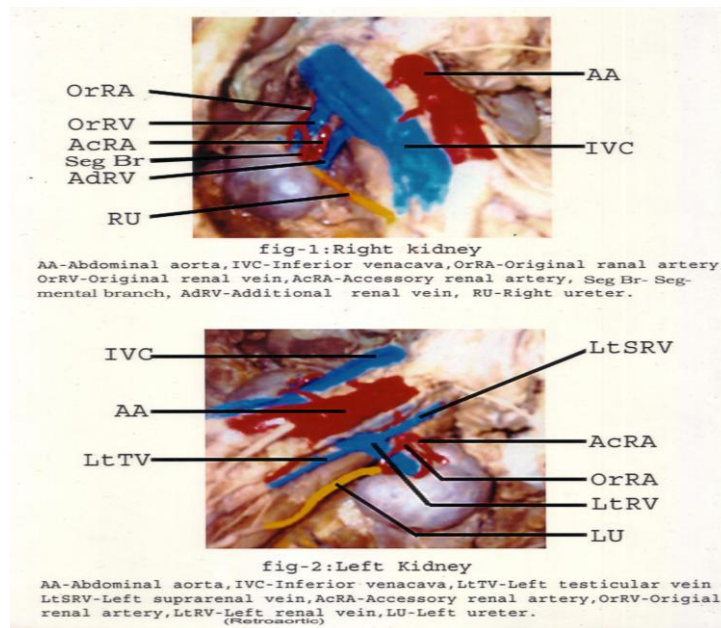
### MATERIAL AND METHODS

During routine dissection at department of anatomy, Malda Medical College, a very rare anomaly of renal vessels was observed in a 60 year old male cadaver.

### OBSERVATIONS

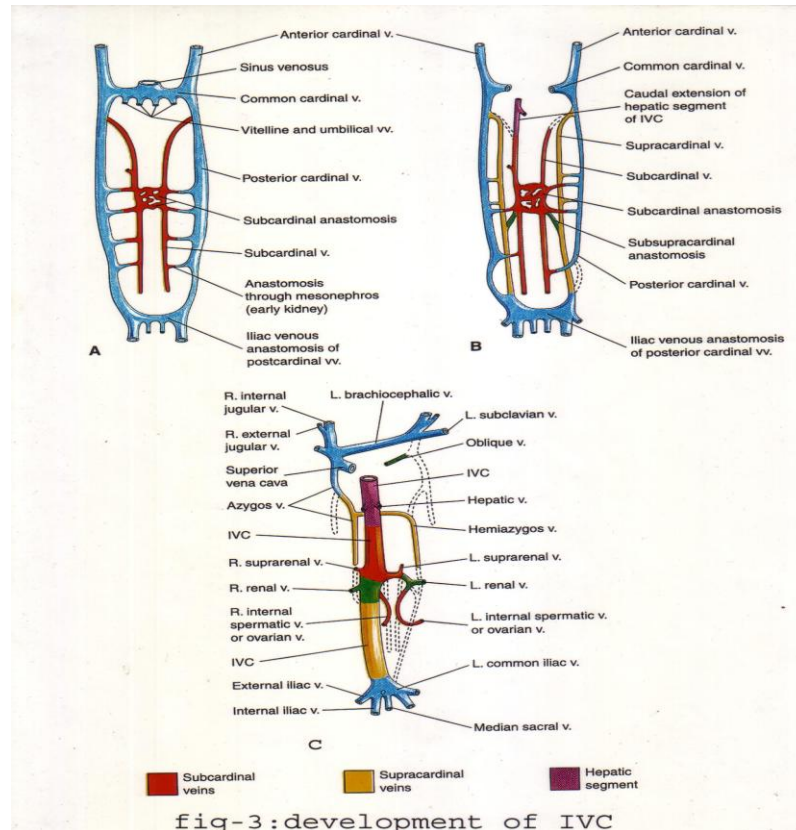
**RIGHT SIDE:** Abdominal aorta and inferior vena cava were seen normally placed, maintaining their usual relationship. Two renal arteries originating from the abdominal aorta at different vertebra level

were observed. Both arteries were almost of same diameter (3mm).Upper artery was considered as original renal artery because it originated at normal vertebral level i.eL1 vertebra from the right side of aorta. The lower artery was considered as accessory renal artery, because it was arising from right side of aorta at a lower level (i.e L2 vertebra level), as well as entering through the hilum of right kidney, more near the lower pole of kidney. Also the original renal artery was giving a branch before entering the hilum, which was probably the segmental branch. Regarding renal veins, two renal veins were emerging from hilum of right kidney, at L1 and L2 vertebral levels, draining separately into inferior vena cava. Upper renal vein was considered original renal vein as because it was maintaining normal relation with other structures at the hilum. Lower vein was considered additional renal vein which was emerging through hilum behind right ureter, more near the lower pole of kidney. Right ureter was normally coming out through hilum and right testicular vein drained into inferior vena cava as usual (Figure -1).



**LEFT SIDE:** Here also, we came across two renal arteries emerging from abdominal aorta, almost of same calibre (3mm) and, approximately at the same vertebral level i.e., L1 vertebra. Upper artery was considered accessory renal artery, here, which entered the hilum of the left kidney more or less near the upper pole. Lower artery was considered original renal artery which was maintaining usual relationship with other structures present at the hilum of the left kidney. Also, it was seen that original left renal artery was giving an early

branch, probably the segmental branch, before entering the left hilum. Left renal vein was seen receiving its normal tributaries, the left suprarenal and the left testicular veins. But the course of the left renal vein was anomalous. It was seen that, after emerging from the hilum, left renal vein was going behind the abdominal aorta to drain into inferior vena cava. Normally left renal vein crosses in front of the abdominal aorta to drain into inferior vena cava (Figure -2).



**DISCUSSION**

Regarding development of renal veins and inferior vena cava, it's already known that at first a pair of posterior cardinal veins (right and left) appear along the dorsolateral aspect of mesonephric ridge. On the ventromedial aspect of

mesonephric ridge, a pair of subcardinal veins (right and left) develops which receive blood from the mesonephros and they establish a pre-aortic anastomosis between them. Subcardinal veins join with posterior cardinal veins both at the cephalic and caudal end. In addition several

transverse communications develop dorsolateral to posterior cardinal veins. These veins join cranially and caudally with corresponding posterior cardinal veins. In addition the supra cardinal veins also anastomose with the subcardinal veins (Figure-3).

Thus, inferior vena cava develops from the following the following:

- i. Persistent caudal part of right posterior cardinal veins
- ii. Right supra cardinal vein
- iii. Anastomosis between right supra subcardinal veins which receives the right gonadal vein
- iv. Upper part of right subcardinal vein which receives both renal veins
- v. From communication between right subcardinal and common hepatic vein
- vi. From common hepatic vein which is from suprahepatic part of right vitelline vein

In our case, we can explain the anomaly of additional right renal vein, on the basis of changes in point (iv) segment of inferior vena cava formation. That means, the right subcardinal vein which during development received blood from mesonephros, may have persisted as extra communication, forming the additional right renal vein. Among different probabilities this seems to be the most probable explanation.

Presence of accessory renal arteries can be explained embryologically as persistent lateral splanchnic branches of abdominal aorta during ascent of kidney from groin to loin.

Also, the retroaortic left renal vein may be due to persistent post aortic anastomosis between two subcardinal veins.

Kater and Gray showed as many as five renal arteries on a number of occasions but usually multiple renal arteries are

limited to two to three. Pick and Anson <sup>(2)</sup> (1940) reported bilateral extrahilar arteries in about 43% of cases. Harvey <sup>(3)</sup> (1914) reported the accessory renal artery from an origin below the origin of inferior mesenteric artery which passed markedly upwards to reach the kidney. Anson, Richardson and Meneiere <sup>(4)</sup> (1936) reported in their study that about half of the supernumerary vessels arising from the aorta enter the hilum while about half went to one or the other pole of the kidney. Merklin and Michaels <sup>(5)</sup> (1958) observed renal arteries vary in their level of origin (the right one often being superior), and in their calibre, obliquity and precise relation in almost 11,000 kidneys. Fourman and Moffat <sup>(6)</sup> (1971) showed vascular pattern of renal arteries. Schneider et al <sup>(7)</sup> (1969) observed each renal artery gives off one or more inferior suprarenal arteries and also branches to perinephric tissues in its extra renal course. Horacek et al <sup>(8)</sup> (1986-87) had given detailed accounts of renal arteries and its microvasculature. Dhar <sup>(9)</sup> (2002) reported segmental branches or right renal artery sandwiched between the two right renal veins. Anomalous renal arteries arising from the aorta tend to be large ones but accessory renal arteries may also arise from the relatively small suprarenal or gonadal arteries, excluding ectopic kidneys to which the blood supply is frequently multiple and almost always anomalous in origin.

As already noted, multiple renal veins on the right side are not uncommon occurring in about a fourth of individuals. They tend to be less numerous than multiple renal arteries. Harvey <sup>(3)</sup> (1914) in a case report showed that both multiple renal arteries and veins bilaterally. However, the lowest veins from both sides were said to empty into a common trunk which passes down to the left common iliac veins, which may be the persistent caudal

part of posterior cardinal vein that were interconnected by an oblique venous channel, persisting in adults as left common iliac vein. He also noticed two other veins emerging from left kidney, encircling the aorta which may be the persistent pre and post aortic anastomosis between two subcardinal veins. Pick and Anson <sup>(2)</sup> (1940) found multiple renal veins on the left side in only 1% cases. Dhar <sup>(9)</sup> (2002) reported emergence of two renal veins at the hilum of right kidney, which drained separately into inferior vena cava (which is similar to our case and probable cause has been previously explained). Turkey (2003) reported a case of bilateral additional renal arteries and an additional right renal vein associated with unrotated kidneys. Biswas and Chattopadhyay <sup>(10)</sup> (2004) reported a case with a variation in right renal and testicular veins, Senecail and Nonent <sup>(11)</sup> (2004) reported two rare anomalies of left renal vein, a circumaortic venous ring and a retroaortic bifid left renal vein.

## CONCLUSION

Thus, we see that in our case, the anomaly can be explained embryologically.

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These anatomical variations are of immense importance because of its implications in various renal transplantations, renal surgeries, uro-radiology and gonadal surgeries. The knowledge of these variations could help the clinician in its recognition and protection. The unrecognized presence of polar vessels is a hazard in surgery. Fortunately, extrahilar veins are more easily damaged and less easily detected than extrahilar arteries which occur much less frequently than the latter. Apart from the danger of damage during surgical procedures, extrahilar or polar arteries can cause hydronephrosis resulting from obstruction of the ureter in the ureteropelvic region when the lower polar vessels pass in front of the ureter. Gillaspie, Miller and Baskin <sup>(1)</sup> (1961) found an anomalous vessel associated with hydronephrosis in 20 of 27 patients operated upon. Also it has been seen in right cadaveric kidney transplantation, that, the right renal vein may be difficult for anastomosis, especially in obese recipients in whom iliac vessels are deep.

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