

Research Article: Human Anatomy Case Report

## Retro-aortic left renal vein - An anatomic variation description and review of literature

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### Summary

This study reports the presence of a retro-aortic renal vein on the left side draining into the inferior vena cava. This variation was observed during routine dissection in a female cadaver aged about 55 years. This variation is of importance because of its implications in renal transplantation, renal surgery, vascular surgery, uro-radiology and gonadal surgeries. The knowledge of such variations can help the clinicians for its recognition and protection.

### Key words

Retro-aortic renal vein; left renal vein; gonadal vein; renal transplantation.

### Introduction

Kidneys are drained by two renal veins, one right and one left. The left vein is three times longer than the right. Hence the left kidney is the preferred site for live donor nephrectomy. The left renal vein has a course in front of the abdominal aorta and behind the superior mesenteric artery. Finally it opens into the inferior vena cava at right angle. The left gonadal vein enters it from below and the left suprarenal vein from above. Occasionally the left inferior phrenic vein also joins the left renal vein. The left renal vein may be ligated during surgery for aortic aneurysm because of its close relationship with the aorta: this seldom results in any harm to the kidney because of adequate collateral drainage (Standring, 2008).

Awareness of various developmental variations of the left renal vein plays a major role while planning a splenorenal shunt for decompression of portal hypertension (Sones et al., 1978). Anomalies of the left renal vein may represent real traps in the interpretation of abdominal imaging, particularly in CT scanning (Cocheteux et al., 2001) or in magnetic resonance imaging (Carriero et al., 1994). These anomalies may modify the values obtained by catheter sampling for suprarenal hormonal levels (Satyapal et al., 1999).

Knowledge on the developmental anomalies of veins is important to avoid vascular injury during retroperitoneal procedures. Particularly in renal transplantation the com-

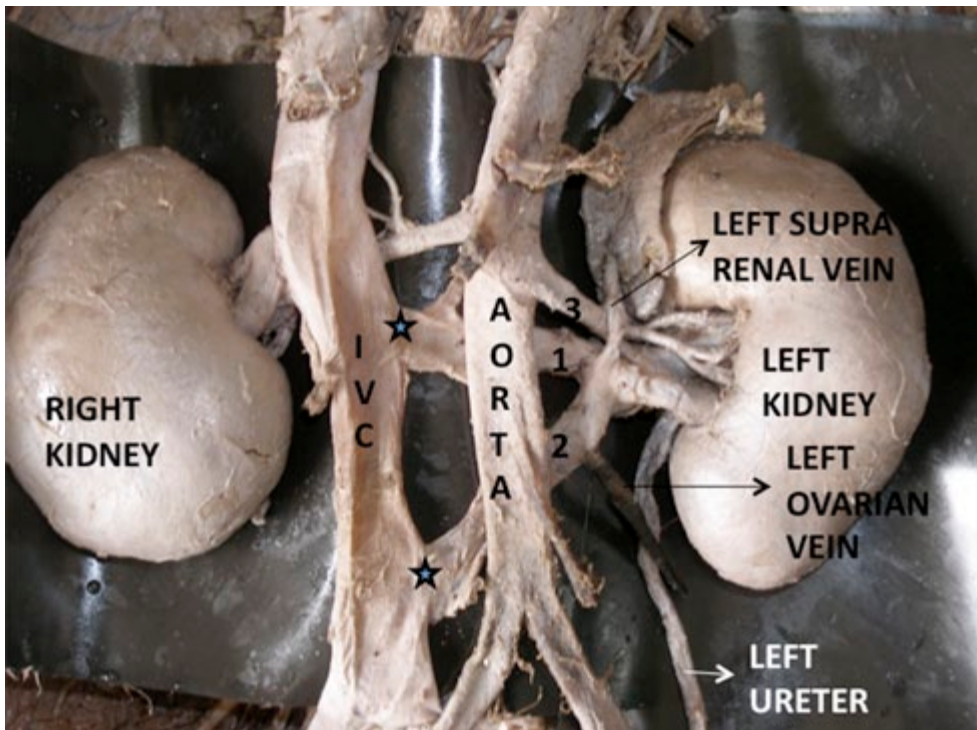
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plexity of the venous anomalies of the left renal vein may modify the technical possibilities of the surgical procedure (Sampaio and Aragio., 1990; Satyapal et al., 1999).

In view of the practical importance of such variations in renal transplantation, renal and gonadal surgeries, uroradiology, gonadal color Doppler imaging and other retroperitoneal, therapeutic and diagnostic procedures, the present case is reported.

### Case report

During routine dissection of a female cadaver aged about 55 years at the Department of Anatomy, P.E.S Medical College, Kuppam, Andhra Pradesh, a variation in the left renal vein was observed. The specimen was carefully dissected. Before taking the picture, an X-ray sheet was placed behind the kidney, ureters and the vessels to get a better view. The left renal vein was found to be formed by confluence of veins at the hilum of the kidney (Fig. 1). It was behind the left renal artery and in front of left ureter. After its emergence, the left renal vein had a short course, after which it bifurcated into a superior and an inferior segment. Both these limbs were found to course



**Figure 1** – Retro-aortic left renal vein. 1, upper segment of the left renal vein; 2, lower segment of the left renal vein; 3, left renal artery; ★, point of termination of renal tributaries into the inferior vena cava. The left ovarian vein is seen opening into the lower segment of the renal vein.

behind the aorta. The superior segment entered the inferior vena cava 1.5 cm distal to the point of entry of the right renal vein. The inferior segment entered the inferior vena cava 2.5 cm distal to the superior segment. The inferior segment received the left ovarian vein. At the point of bifurcation, the left suprarenal artery entered the renal vein. On the right side, no particular variations in renal blood vessels origin, course and distribution was noticed.

## Discussion

The described findings were noticed in one out of forty cadavers dissected. Possible embryological bases of the present observation are the following. During the development of the inferior vena cava, the renal collar forms a circum-aortic ring. It is contributed by sub-cardinal veins and inter-subcardinal anastomosis anteriorly, by supra-cardinal veins and inter-supracardinal anastomosis posteriorly, and on each side by supracardinal-subcardinal anastomosis (Williams, 1995). It is identifiable in a 15 mm embryo. In a 22 mm long embryo, after the definitive position of metanephros has been attained, the permanent venous pattern begins to appear (McClure and Butler, 1925).

The bilaterally symmetrical cardinal venous system converts into unilateral right-sided inferior vena cava at around 8 weeks. Sometimes veins on the left side fail to disappear completely, leading to left sided inferior vena cava.

Very few reports have documented notable morphologic variants of the left renal vein like "a circum-aortic venous ring" and "a post-aortic (retro-aortic) vein." (Satyapal, 1999; Malcic-Gurbuz et al., 2002; Senecail et al., 2003).

The present case could be due to persistence of the anastomosis between the sub-cardinal and supracardinal veins resulting in varied formation and termination of left renal vein and in its retro-aortic course.

In an extensive study by Satyapal, (1995) on 306 kidneys, the classification of the drainage pattern of renal veins was done on the basis of the drainage pattern of primary tributaries of the renal vein on both sides. Kidneys exhibiting a retro -aortic bifid renal vein were classified as Type 3, using the drainage pattern of primary renal tributaries and renal vein proper as a basis. This classification is as follows: Type IA - two primary tributaries only, an upper and a lower one. Type IB - In addition to upper and lower primary tributaries, a posterior primary tributary is present. Type II A - This group showed the presence of more than two primary tributaries (maximum of five). Type II B - In addition to primary tributaries, a posterior primary tributary was present. Type III - This group consisted of any of the previous types with one or more additional renal veins. A study of left renal vein variation in 1008 cases showed retro -aortic vein in 0.5% cases and an additional vein in 0.4% cases (Satyapal, 1999).

In a case reported by Malcic-Gurbuz et al. (2002), the left renal vein divided into three branches. The upper branch drained into the azygos vein, while the lower two branches drained into the inferior vena cava.

Senecail et al. (2003) reported two uncommon anatomical variations of the left renal vein. The first specimen with a circum-aortic venous ring resulted from the persistence of the embryonic renal venous collar. The second specimen showed a partially bifid and retro-aortic left renal vein, considered as a particular pattern of left inferior vena cava.

Kaneko et al. (2008), who studied extensively on renal vascular variations in 190 cadavers, observed double left renal veins in 2 cadavers. In one cadaver, a circum-aortic venous ring was seen, and in another cadaver, a single retro-aortic left renal vein with an oblique downward course. So the incidence of variations of the left renal vein in that study was 0.6%.

With reference to the literature cited, the present case is a rare developmental variant and is of significance surgically and radiologically.

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