

Additional right renal veins: clinical implication.

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ABSTRACT

Background: Each kidney is drained by single renal vein on each side. Right renal vein is shorter than left renal vein and both veins drain into inferior vena cava. The aim of our study is to find the variation in renal vasculature at the renal hilum. **Methods:** The present study was conducted on the 30 embalmed cadavers (20 males and 10 females) in the Department of Anatomy of SRMS IMS, Bareilly from 2006 to 2015. **Results:** The present study revealed the presence of two additional renal veins on the right side along with the normal right renal vein in one cadaver (3.33%). **Conclusion:** Therefore, it is crucial to understand the variation of renal vein as this is important for the designing of catheter, angiography, renovascular hypertension, treatment of renal trauma and renal artery embolization. Therefore, the variation of renal vein should be kept in mind during transplantation and to prevent bleeding by an accidental trauma when operating in the retroperitoneal region.

Keywords: Catheter, renal, transplantation, veins.

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INTRODUCTION

It is crucial to understand the variation of renal vein as this is important for the designing of catheter, angiography, renovascular hypertension, treatment of renal trauma and renal artery embolization. Therefore, the variation of renal vein should be kept in mind during transplantation and to prevent bleeding by an accidental trauma when operating in the retroperitoneal region. These variations remain unnoticed until being discovered during surgery or during autopsy.

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The clinically significant incidence of variations was reported as follow 47% multiple renal arteries, 13% multiple renal veins.^[1] The renal veins show less variation than the renal arteries.^[2,3] The incidence of additional renal veins reported to be 3.3 % on right side & 2.6 % on left side.^[4] The variation of left renal vein is more common as compare to right renal vein

because of complex embryological development of left renal vein. Normally one right renal vein open directly into the inferior vena cava without receiving tributaries. The right renal vein has no significant collateral drainage and cannot be ligated with impunity.^[5] Renal veins enter the inferior vena cava on the right side of the median plane. Thus the right renal vein is much shorter than the left. The right renal vein is behind the descending duodenum and sometimes the lateral part of the head of the pancreas. It can be extremely short (<1 cm) such that safe nephrectomy may require excision of a cuff of the inferior vena cava.

Using the drainage pattern of the primary renal vein tributaries and renal vein proper the kidneys were classified into 3 major types:^[6]

Type 1a: Consist of 2 primary tributary only – an upper and a lower

Type 1b: In addition to upper and lower primary tributary, a posterior primary tributary is present

Type 2a: Existence of more than 2 tributaries, e.g. upper, middle and lower,

Type 2b: In addition to the primary tributaries present in 2a, a posterior primary tributary was present.

Type 3: Any of the previous classification together with an additional renal vein/veins.

According to K.S. Satyapal a renal vein is one which

is formed from the convergence and union of varying number of the primary tributaries emerging from the kidney and which terminates separately into the IVC. Any additional vessel that drains separately from the kidney and independently into the IVC should be considered as a normal variation and be named an additional renal vein.^[6]

MATERIALS AND METHODS

The present study was conducted on the 30 embalmed cadavers (20 males and 10 females) in the Department of Anatomy of SRMS IMS, Bareilly from 2006 to 2015. Dissection was done according to Cunningham's Manual of Practical Anatomy, 15th edition.

In cadavers, the hilum of left and right both kidneys were observed in the pattern of the renal artery and renal vein. During dissection of the retroperitoneal region of male cadaver, a variant drainage pattern of the right renal vein was observed.

RESULTS

The right and left kidneys of cadavers were dissected, observed and findings were noted down. The present study revealed the presence of two additional renal veins on the right side along with the normal right renal vein in one cadaver (3.33%). The authors named the vessels superior additional renal vein (SARV), middle renal vein (MRV), inferior additional renal vein (IARV), according to its location while draining into the inferior vena cava (IVC) [Figure 1].

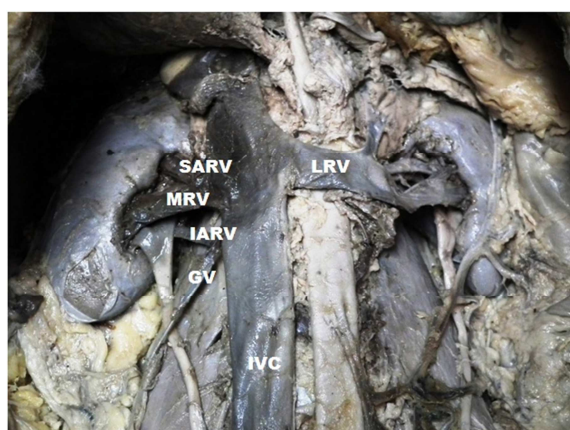


Figure 1: Showing superior additional renal vein, inferior additional renal vein, middle renal vein, gonadal vein and left renal vein.

On the right side, SARV emerges from the upper portion of hilum drains into inferior vena cavae at the site of drainage of normal renal vein and present anterior to pelvis of ureter. Another IARV also drains into inferior vena cavae retroperitoneally at the site of drainage of right gonadal vein and it opens into inferior vena cavae below the opening of middle renal vein. Both superior and inferior additional renal vein opens into inferior vena cavae at an acute angle and middle renal vein open into inferior vena cavae at right angle. Right gonadal vein opens into inferior vena cavae near the opening of inferior additional renal vein [Figure 1].

Thus, according to the classification types of renal venous drainage patterns given by K.S.Satyapal (1995), the above abnormality comes under type III category.

The diameter of left renal vein was larger than right renal vein. Right and left renal vein open into inferior vena cavae opposite to each other. The length of left renal vein was 32.37 mm. Left kidney was also found to have two renal veins which emerged from the hilum, passed medially and joined with each other to form a single left renal vein. This common renal vein passed in front of abdominal aorta to enter the inferior vena cava at right angle.

The length of renal veins on right side are given below-

Table 1: Length of renal veins

Right renal vein	Length (mm)
Superior additional	49.43
Middle	30.98
Inferior additional	40.13

In our study, we found the length of left renal vein was slightly larger than middle renal vein while lesser than additional veins.

DISCUSSION

Fernandes et al.^[7] suggested the embryological basis for the development of additional right renal vein that there was an error on the fusion of the branches to the dorsal mesonephros derived from the right postcardinal vein, the dorsal –medial branches of the right supracardinal vein and the ventral branches of the right subcardinal vein (the latter represented by the IARV, marked by the presence of its testicular tributary).

Bergman et al.^[3] observed that, the renal veins show less variation than do the renal arteries and multiple renal veins to be rare on the left side (1%) and common on the right side (28%). The right renal vein may be doubled, even though the left renal vein is usually single. In our study, we observed two additional right

renal veins along with one right renal vein (3.33%) along with left renal vein in one cadaver.

K.S.Satyapal^[6] observed that in the case of type III renal venous drainage, there was a tenfold increase in the number of kidney on the right side. In our study, we also found a type III pattern of renal drainage on right side.

K.S.Satyapal^[8] studied on 153 renal specimens and found that second additional renal vein occurred infrequently on the right side (5%), while in our study, we observed one cadaver having two additional right renal veins along with one middle renal vein (3.33%).

K.S.Satyapal^[4] found that the variations among the renal veins are not as common as arteries. Very few cases of additional renal veins have been reported. The incidence of additional renal veins reported to be 3.3% on right side and 2.6% on left. These findings coincide with our findings.

Ballesteros L E et al.^[9] studied a sample of 156 pairs of kidneys, in which five had three renal veins (3.2%) out of the specimens with multiple right renal veins. They also observed type III renal venous drainage in 21.2% on right side. We also observed type III renal venous drainage in 3.33% on right side. They also reported out of 39 additional renal veins six (15.3 %) originated at the hilum. We also observed additional renal vein originate at the hilum (3.33%). The sample size of Ballesteros L E et al. is larger as compared to our size. Therefore, findings may be different.

Lowe FC¹⁰ and Singh G¹¹ said about the role of additional renal vessels in the obstruction of ureteropelvic junction causing hydronephrosis remains controversial, and the retrorenal presence of the variant is more likely to be associated with ureteropelvic junction obstruction. In our study we also observed inferior additional renal vein which is present retrorenally but we cannot comment on its role in causing hydronephrosis as it is cadaveric study.

Baptista –Silva J.C.¹² found on the right side a double renal vein in 29%, and triple or more in 9.7% of the 31 nephrectomies. So our findings become rare i.e. the presence of three renal veins (one normal vein and two additional renal veins on right side).

Alp Bayramoglu^[13] reported a case of retrorenal additional right renal vein associated with unrotated kidneys. We found one case of additional veins on right side.

Bhadresh P Vaghela et al.^[14] conducted study on 50 cadavers and they did not find any case of accessory renal vein. Though, in one case we found accessory renal vein out of 30 cadavers.

According to Gray's Anatomy^[5] the length of right renal vein is 2.5 cm which is one third of the length of left renal vein. While in our study the length of superior additional, inferior additional and middle renal vein (4.94, 4.01 & 3.09 cm) is larger as compared to the

above given length of right renal vein. We found in our study the length of left renal vein is 3.23 cm which is less than the length of left renal vein as mentioned in standard text book (Gray's Anatomy).

Krishnasamy N et al.^[15] reported that the normal right renal vein opened into IVC opposite the left renal vein and the accessory renal vein about 4 cm below the normal. We also observed that normal right renal vein opened in IVC opposite the left renal vein and superior and inferior additional vein above and below normal right renal vein.

CONCLUSION

The level of entry of renal veins into inferior vena cavae is important as these findings are clinically important for angiography, catheter design, treatment of renal trauma, renal transplantation, renal artery embolization, angioplasty or vascular reconstruction for congenital and acquired lesions, surgery for abdominal aortic aneurysm and conservative or radical renal surgery. During such procedures, above abnormality should be kept in mind (triple renal veins opening into the inferior vena cavae).

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