

## Study of Left Renal Vein, its Anatomy, Variations and its Clinical Significance-A Prospective Study

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### Abstract:

**Aim of the study:** To study the anatomy of left renal vein its variations and its clinical significance.

**Materials & Methods:** Cadaveric dissection method: 22 cadavers, 8 enbloc specimens used for undergraduate and post graduate study purpose were used over a period of 2 yrs. Radiological method: 20 Multi detector CT abdomen Cases were studied

**Results:** The results obtained include the variations of left vein, and its clinical significance were discussed and compared with previous standard studies.

**Conclusion:** Variations like retroaortic and circumaortic left renal vein are the cause for nut cracker syndrome and pelvic congestion syndrome. Relation with renal artery gives the information needed in surgical procedures.

**Key words:** Left renal vein, retroaortic, circumaortic, nut cracker syndrome.

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Date of Submission: 17-08-2017

Date of acceptance: 28-08-2017

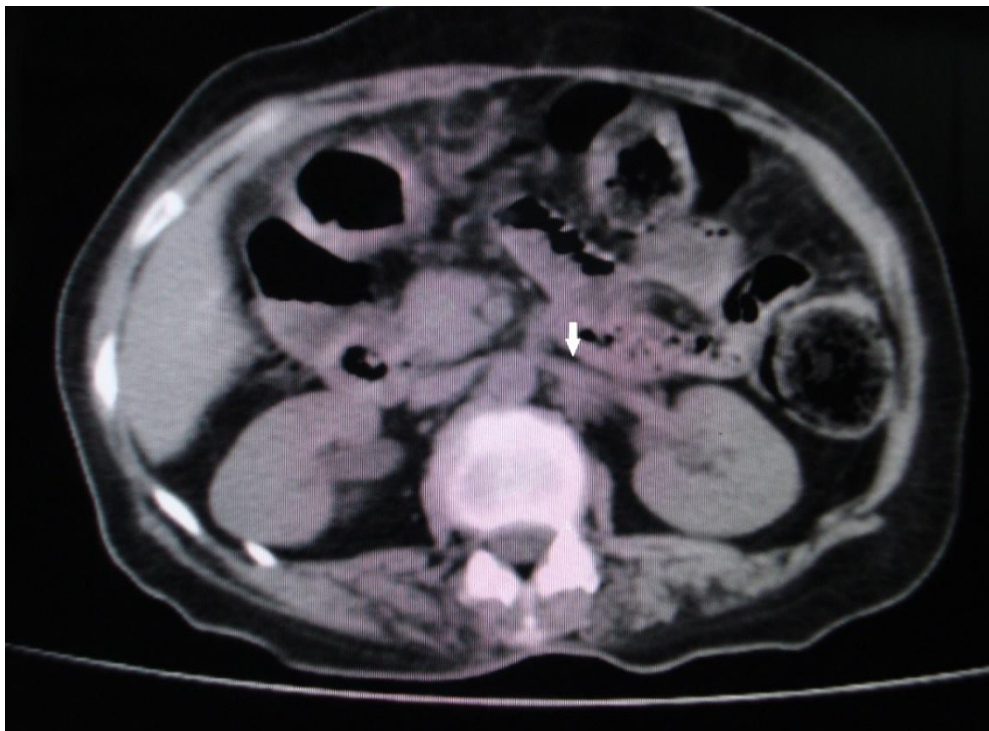
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### I. Introduction

In the modern era of all organ transplantation, the live and cadaveric transplantation of kidneys is very commonly done in day today medical practice. In favour of recent trend in conservative transplantation surgeries a meticulous knowledge of anatomy and congenital variations of vascular structures is very important for general surgeons, radiologists and speciality surgeons. A basic law of vascular anatomy for all organs is that only thing which remains constant is its variability. Renal venous system lacks exhaustive studies when compared to renal arterial system. Left kidney & left renal artery/ vein is the preferred and favoured side for donor nephrectomies to the renal transplant surgeons. So left renal vein is very important, As a surgical landmark for the vascular surgeons in abdominal aortic surgeries, As a diagnostic tool for radiologists where variations of left renal vein do occur, As a cause for renovascular hypertension (in nut cracker phenomenon, and renal vein thrombosis) in medicine due to its abnormal course, & As a cause for pelvic congestion syndrome in obstetrics & gynaecology. When compared to right renal vein which lacks all these features except for the fact that accessory renal veins are quite frequent on the right side. So the purpose of present study is to describe and discuss the variations on the basis of their occurrence.

### II. General Anatomy

The left renal vein emerges from the left renal hilum, in front of left renal artery. It runs posterior to the splenic vein and the body of pancreas, then crosses the anterior aspect of the aorta, just below the origin of the superior mesenteric artery to drain into the inferior vena cava. The left gonadal (testicular/ovarian vein) enters it from below. The left suprarenal vein, usually receiving one of the left inferior phrenic veins, enters it above but nearer the midline. The left renal vein is three times longer than the right (7.5 cm and 2.5 cm respectively). Compared to the left the right renal vein takes a short course and joins the inferior vena cava. The right suprarenal and right gonadal vein opens directly into the inferior vena cava.



Multidetector Computed Tomography (MDCT) Axial Section of Abdomen At The Level Of Kidneys Showing Left Renal Vein

### **Embryogenesis of Left Renal Veins And Its Communications**

#### **Embryogenesis**

Between 6-8 weeks of intrauterine period, by a complex process involving development, anastomosis and regression of 3 pairs of embryonic venous channels lying in proximity to developing mesonephros, the left renal vein and its tributaries are formed. In order of appearance, Left and right posterior cardinal veins appear on dorsal side of mesonephri followed by Left and right subcardinal veins on medial and ventral aspect of mesonephri. The left and right supracardinal veins appear dorsal and medial to posterior cardinal veins. (Huntingdon and McClure)<sup>7</sup>, (Frazer)<sup>3</sup> The subcardinal veins communicate cranially and caudally with posterior cardinal veins, while themselves receiving veins from the developing kidneys. At the level of renal veins, the 2 subcardinal veins become connected by a transverse inter subcardinal anastomosis (10mm length- 37 day embryo). The supracardinal veins communicate cranially and caudally with posterior cardinal veins and also communicate with subcardinal veins through anastomosis just below renal veins.

The left renal vein is derived from: A) mesonephric vein that originally drains into left subcardinal vein, B) a part of left subcardinal vein, C) the inter-subcardinal anastomosis. As this anastomosis lies in front of aorta, the left renal vein has a similar relationship. The left suprarenal vein is formed by part of left subcardinal vein above the inter-subcardinal anastomosis. The left gonadal vein is formed from part of left sub-cardinal vein below the inter-sub-cardinal anastomosis.

### **III. Materials And Methods**

22 embalmed and preserved adult human cadavers.

- 8 postmortem en bloc specimens.
- 20 patients in radiology department who came for CT abdomen for varied indications

#### **Method of study**

##### **Cadaveric study**

Study was done on 22 embalmed and preserved human cadavers of both sexes that were put in for the teaching programme of undergraduate & postgraduate medical students at the Department of anatomy, and 8 postmortem en bloc specimens obtained from Department of forensic medicine, Stanley medical college, Chennai

**Radiological study**

20 patients with varied abdominal symptomatology that came for contrast enhanced CT abdomen for varied abdominal indications were taken up for this study at the dept of Radiology, Stanley medical college, Chennai.

For the above patients only images were taken with data already available in the department with both contrast study of abdomen done in both arterial & venous phase and plain CT abdomen to delineate structures in a better way.

**By Conventional Dissection Method As Per Cunningham’s Dissection Manual<sup>8</sup>.**

The anterior abdominal wall was incised and opening of abdominal cavity in the midline was done. Peritoneal cavity and viscera were defined and studied. Removal of stomach, liver, jejunum, ileum with their mesentery, transverse colon with mesocolon was done. The posterior parietal peritoneum was defined and stripped off exposing the retroperitoneal structures (Inferior vena cava, abdominal aorta, sympathetic chains, suprarenal and kidneys with fascial coverings, psoas muscle with its fascia). Left renal hilum cleared to visualise and delineate hilar structures. The pattern of extra hilar confluence of tributaries in forming left renal vein with respect to its number and relation to left renal arterial branches was studied. Left suprarenal vein, left inferior phrenic vein were traced from above. The pattern of termination of left gonadal vein into left renal vein was traced out. Left kidney was lifted from underlying psoas major and quadratus lumborum muscle, turned medially to expose the posterior part of renal pelvis. Careful clearing of fat pad from retroperitoneal area was done to visualise the presence or absence of retroperitoneal veins or venous anastomosis. Left psoas major muscle defined and its fascial coverings stripped off. The main left renal venous trunk was followed across the aortic terrain and whether its course as preaortic (normal), retroaortic or circumaortic towards Inferior vena cava was noted.

**By radiological method,**

Images obtained from Multidetector Computed tomography (MDCT) from 20 patients, were reconstructed into coronal and axial views. Its relation to left renal artery and incidence of left renal vein variants was observed in both views.

The following 2 parameters were taken for the present study. (both dissection and radiological method)

1. Incidence of left renal vein variants.
2. Relation of left renal artery to left renal vein.

**Observation:** Observation made upon 22 human adult cadavers, and 8 en bloc specimens along with parameters studied by radiological method in 20 pts in total are analysed and summarised

**1. Incidence of left renal vein variants**

No. Of specimens	5	0	%
Retroaortic left renal vein	2		4
Circumaortic left renal vein	1		2

**2. Relation of left renal artery to left renal vein (as per berry and daseler’s classification)<sup>2</sup>**

No. Of specimens studied - 50

Left renal artery dorsal to left renal.v	1	8	3	6	%
Left renal artery descending to ventral position	1	8	3	6	%
Left renal artery ascending to ventral position	0	6	1	2	%
Left renal artery cranial to left renal.v	0	8	1	6	%

It could be summarised that relation of left renal artery to left renal vein being dorsal and descending to ventral position are equally common. The next frequent position being left renal artery cranial to left renal vein.

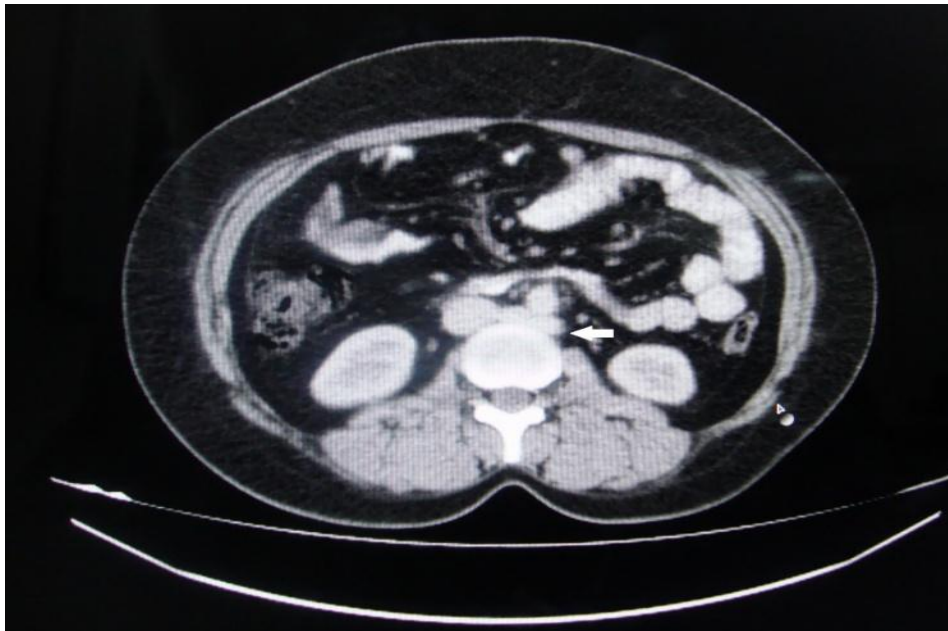
**IV. Discussion**

Anatomically and radiologically and surgically valued parameters and variations of left renal vein that were observed, were analysed and put on stand for a comparative trial with extensive work done by many previous eminent people.

**1. Incidence of left renal vein variants:**

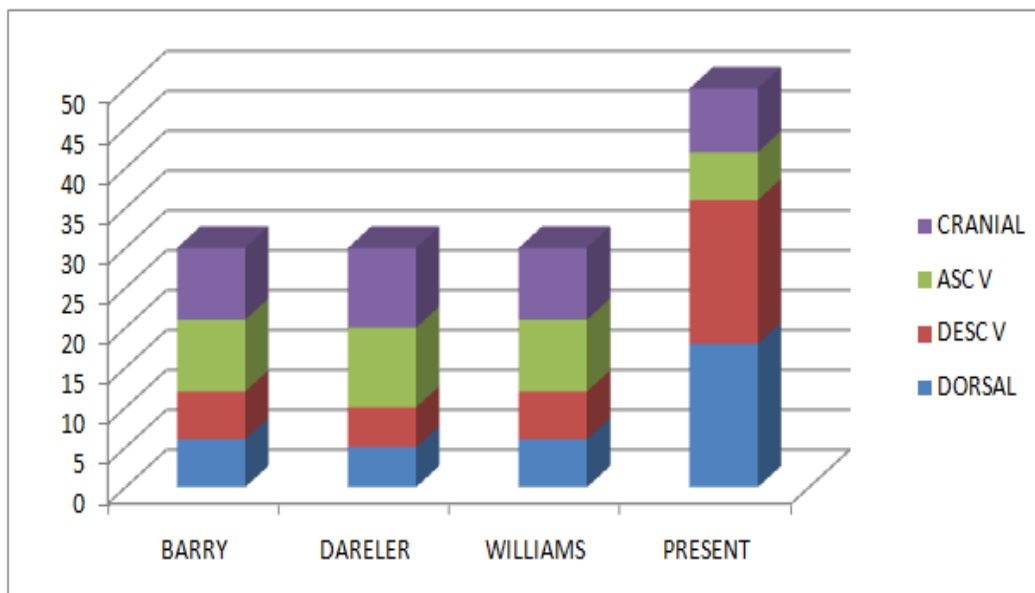
Many authors have reported about variations of left renal vein and so their incidences are being formatted into a tabulation along with incidence of present study and presented.

S . N o	Author (cases studied)	Y e a r	Circumaortic	Retroaortic
1	Martinez Almagro et al <sup>6</sup> (286)	1 9 9 2	-	6 %
2	Hicks et al <sup>5</sup> (108)	1 9 9 5	11 %	1 . 8 %
3	Coll et al <sup>4</sup> (69)	1 9 9 9	4.3 %	-
4	Shindo.S et al <sup>11</sup> (166)	2 0 0 0	0.6 %	-
5	Aguilar Rivilla.E.et al <sup>1</sup> (101)	2 0 0 2	4 %	-
6	K.S Satyapal <sup>9</sup> (50)	2 0 0 3	0.3 %	0 . 5 %
7	Present study (50)	2 0 1 2	2 %	4 %



**2. Relation of left renal artery to left renal vein:**

BARRY J ANSON and EDWARD H. DASELER, (1961)<sup>2</sup> gave incidence of left renal artery's relation from 125 specimens as, Dorsal to vein -61 (4.76%), Descending to ventral position- 51 (42%), Ascending to ventral position - 3 (2.4%), No relation to vein 10 (8%), concluding that dorsal to vein as the commonest. WILLIAMS et al., (1995)<sup>12</sup> in Gray's anatomy stated left renal vein being anterior to left renal artery. PRESENT STUDY incidence of left renal artery's position of : Dorsal to vein- 36%, Descending to ventral - 36%, Ascending to ventral 12%, Cranial with no relation - 16% differs from BARRY, DARELER'S, and WILLIAM'S by having an equal incidence for dorsal and descending to ventral position and in having higher incidence for ascending to ventral and cranial positions.



## V. Conclusion

The present study shows the variations of left renal vein course as retroaortic and circum aortic, that is responsible for nut cracker syndrome and pelvic congestion syndrome. The knowledge of relation of left renal vein with renal artery plays a major role in surgical procedures like transplantation surgeries and uological procedures.

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