

## ORIGINAL RESEARCH

### Variation in the origin of renal arteries from vertebral level in Western U.P. Population: An Angiographic Evaluation.

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#### ABSTRACT

**Background-** Variations of renal artery are common in general population and gained importance because of the wide spread development in renal transplantation surgery. The purpose of this retrospective study was to evaluate the prevalence of variations in the origin of right and left Renal arteries at Vertebral level.

**Method and materials-** The data was collected by using CT Scan machine G.E 64 slice with software Syngo angiography of 100 patients was collected. CT angiography scan was made and thin slices (0.6 mm) axial images were obtained. The variation in the origin of renal arteries at the level of vertebral column can be evaluate by 3-D CT angiography results were analyzed. A correlation is considered significant when  $p < 0.05$ . Most of the possible correlations were examined. For comparing continuous variables, the t-test was applied. All the statistical analysis was done by SPSS software.

**Result -** The most frequent position of RRA origin at vertebral level L1 LP are 32 %, L1 MP are 16%, L1UP are 8% and also L2 UP are 32%, L2 MP are 10%, L2 LP are 2% cases. Vertebral levels of left renal arteries L1 LP are maximum in 38 % cases. Others are L2 UP in 32%, L1 MP 20%, L2 MP 6% and L1 UP & L2 LP are 2% in each cases.

**Conclusion-** In our study, Mostly renal arteries are arising in between upper part of L1 to the lower part of the L2 vertebrae.

**Keywords-** Computed Tomography, Right Renal Artery, Left Renal Artery, Upper Part, Middle Part, Lower Part.

#### INTRODUCTION

A pair of kidneys situated in abdominal cavity in between T12-L3 Vertebrae. Hilum of both kidneys is lies at L1 vertebrae. Each kidney is supplied by renal artery which is branch of abdominal aorta. Renal arteries are paired arteries arising laterally from the aorta just below the origin of superior mesenteric artery at the level of inter-vertebral disc between L1 and L2 vertebra. Right renal artery is longer than left renal artery, because abdominal aorta lies on the left side of vertebral column. A single renal artery to each kidney is present in approximately 70% of individuals. The arteries vary in their level of origin and in their calibre, obliquity and precise relations. The subdivisions of the renal arteries are described sequentially as segmental, lobar, interlobar, arcuate and interlobular arteries and afferent and efferent glomerular arterioles.

Variations of renal artery are common in general population and gained importance because of the wide spread development in renal transplantation surgery. A thorough knowledge of

morphological variations of the renal arteries is important for renal transplant surgery as well as for other urological procedures, management of renovascular hypertension, renal trauma and hydronephrosis (5, 6).

The variation in the origin of renal arteries at the level of vertebral column can be evaluated by the Computed Tomography (CT) Angiography. The accuracy of CT Angiography in the evaluation of renal origin varies between 95% to 100% .

The power of contemporary CTA is seen in many ways. For the patient, a comprehensive angiographic study requires only intravenous contrast injection and 10 minutes to 15 minutes in the scanner. For the referring physician, angiographic studies can now be reviewed and therapeutic options considered, allowing the referring physician to participate in the management of the patient before they learn that stenting or bypass grafting has been performed. Because there is little risk for most patients who undergo CTA, there will likely be greater referral for early diagnosis of vascular conditions compared to timing of invasive angiography with its incumbent procedure-related risks. (4).

### **AIMS AND OBJECTIVE**

The Aim of this retrospective study was to evaluate the prevalence of variations in origin of right and left Renal arteries at Vertebral level.

### **METHOD AND MATERIALS**

The data was collected by using CT Scan machine G.E 64 slice with software Syngo angiography of 100 patients was collected.

### **SAMPLE SIZE**

Ct angiogram more than 50 male and 50 females subjects were included in the study.

### **INCLUSION CRITERIA**

Subjects who was free of any signs & symptoms related to kidney pathology

### **EXCLUSION CRITERIA**

Subjects who have

- Hydronephrosis
- Renal calculi
- Arterial pathology such as aneurysm or tumours.

### **METHODOLOGY**

CT angiography was randomly selected from the records of patients who were referred for the scan during the period between June 2014 to June 2015 to from - Dr. O. P. Gupta Imaging center, Meerut.

### **MEASUREMENTS**

- To cover the whole abdominal aorta in each patient, spiral CT angiography scan was made and thin slices (0.6 mm) axial images were obtained.
- Both sagittal and coronal images were reconstructed. 3-D reconstruction was done from the data gained by the spiral CT examination.
- Manipulation of the 3-D images was done by rotation to get the correct planes and deletion of unnecessary anatomical details to clarify the renal artery away from superimposed structures.
- Data were saved to a portable hard disk. The 3-D CT angiography results were analyzed to study the parameter such as: the vertebral level.

The vertebral bodies were divided into upper, middle and lower thirds. All the distances were measured by software program. In order to obtain the centre of the origin of each vessel was taken as the recordable point of origin.

### STATISTICAL ANALYSIS

A correlation is considered significant when  $p < 0.05$ . Most of the possible correlations were examined. The results were recorded in the form of tables and then were subjected to statistical analysis with the purpose of calculating the mean, and SD and finally the correlations between the observed distances. For comparing continuous variables, the t-test was applied. All the statistical analysis was done by SPSS software.

### VERTEBRAL LEVEL OF RENAL ARTERIES

The vertebral level of origin of main renal arteries showed a wide range extending from upper part of L1 vertebra to lower part of the L2 vertebra.

RRA arised at vertebral level L1 LP are (n=16) 32 %, L1 MP are (n=8)16%, L1UP are (n=4) 8% and also L2 UP are (n=16)32%, L2 MP are (n= 5)10%, L2 LP are (n=1) 2% cases.

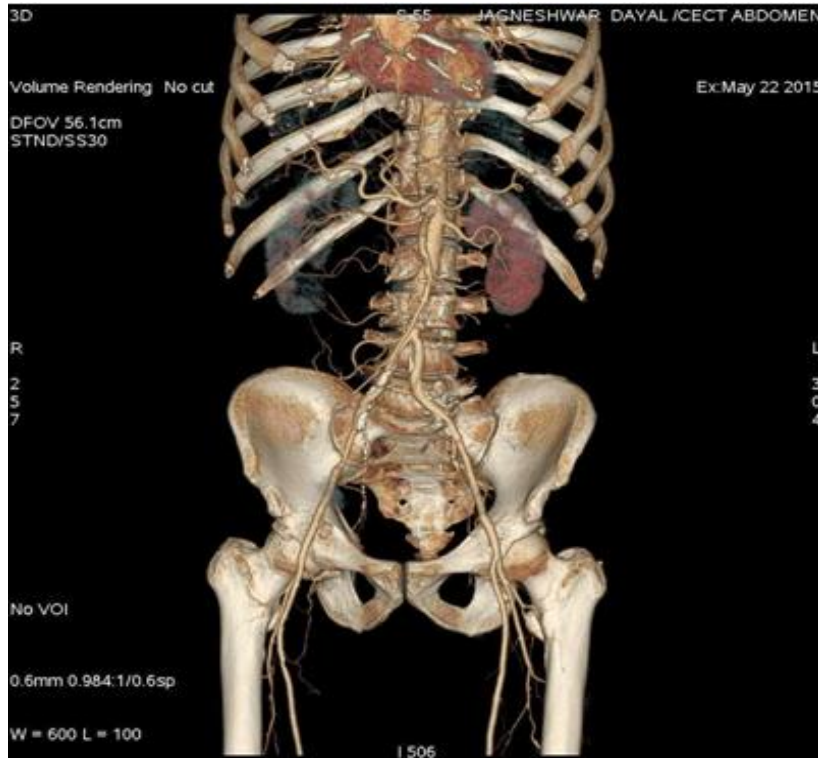
Vertebral level- VL of RRAs					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	L1 LP	16	32.0	32.0	32.0
	L1 MP	8	16.0	16.0	48.0
	L1 UP	4	8.0	8.0	56.0
	L2 LP	1	2.0	2.0	58.0
	L2 MP	5	10.0	10.0	68.0
	L2 UP	16	32.0	32.0	100.0
	Total	50	100.0	100.0	

**Table 1.5: Vertebral level of Main RRA.**

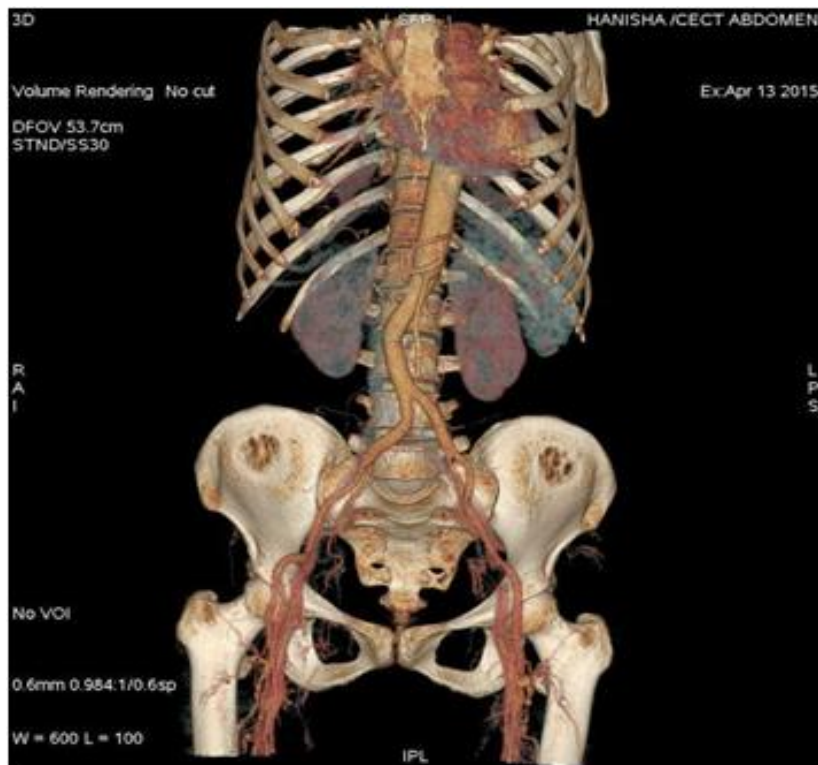
Vertebral levels of left renal arteries L1 LP are maximum in (n=19) 38 % cases. Others are L2 UP in (n=16) 32%, L1 MP (n=10)20%, L2 MP(n=3) 6% and L1 UP & L2 LP are (n=1)2% in each cases.

VL of LRAs					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	L1 LP	19	38.0	38.0	38.0
	L1 MP	10	20.0	20.0	58.0
	L1 UP	1	2.0	2.0	60.0
	L2 LP	1	2.0	2.0	62.0
	L2 MP	3	6.0	6.0	68.0
	L2 UP	16	32.0	32.0	100.0
	Total	50	100.0	100.0	

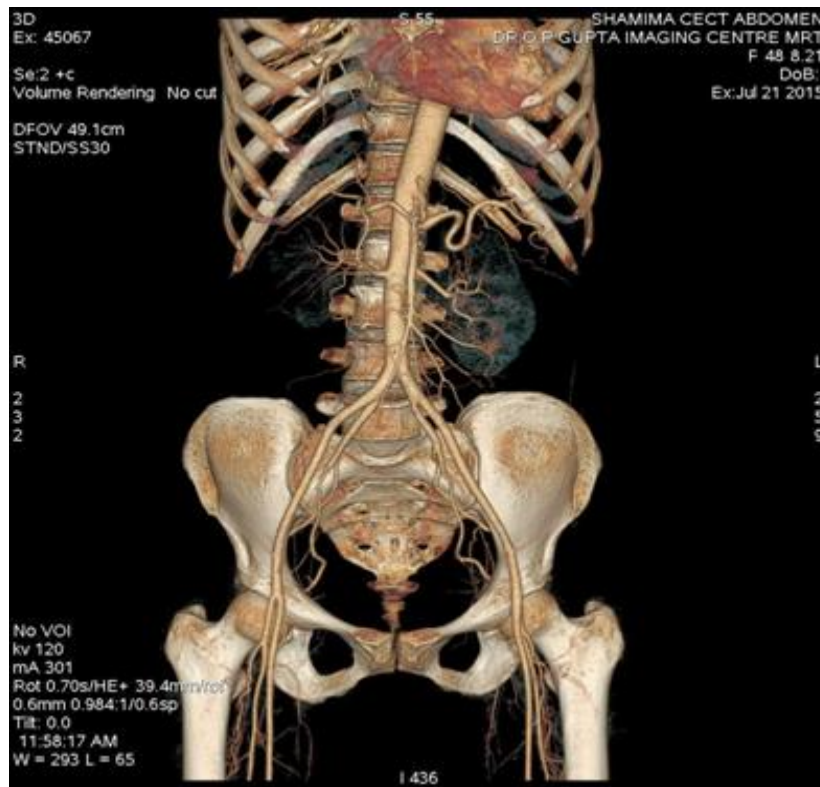
**Table 1.6-Vertebral level of Main LRA**



**Fig.15 - Vertebral level of origin of right and left renal arteries( from L1MP).**



**Fig. 16: Vertebral level of origin of right and left renal arteries( from L1LP at RT. & L2UP at Lt Side).**



**Fig. 17: Vertebral level of origin of right and left renal arteries( from L2LP both sides).**

## DISCUSSION

The vertebral level of origin of main renal arteries extending from the level of upper margin of L1 vertebra to the level of inter vertebral disc between L2-L3 vertebrae. Only 24.53% of renal arteries on the right side and 20.75% on left side were seen to be originating at the level of inter vertebral disc between L1 and L2 which is normally described (38).

Extra left (accessory) RA was found in 6 patients (4 male and 2 female), whereas, extra right RA was found in 8 patients (5 male and 3 female). Overall extra RA was found in 14% of all cases. It was situated at the level between lower L2 and lower L3. (35).

A Saudi population study revealed that the peak and the median of the origin of the right RA is the level of lower third of L1 in 41% of cases. In agreement with this study, the median level of origin of the right RA is the lower part of L1 in cadaveric studies and by digital subtraction angiography. In other studies it arises at the level of the disc between L1- L2 (7, 19, 35).

Median level of origin of the left RA is the disc between L1 and L2. In 76 % of the cases in his study, the level of origin is the disc between L1 and L2 and the upper part of L2. The median level of origin of the left RA in one study by digital subtraction angiography is at the level of the upper part of L2. (7, 19) stated that, the level of left renal artery is the lower part of L1 vertebrae. The right RA is emerging a little higher than the left one.

According to the classic anatomic descriptions, as well as in a research on the origin of the renal arteries in human fetuses (5) and the study on the origin of the renal arteries by angiography renal arteries originating between the vertebrae L1 and L2 were more frequently found, both in the right and left sides. The RAs may arise from the aorta at a point lower than usual, according to the position of the kidneys, and they also tend to be lower in older persons (7).

In our study the vertebral level of origin of main renal arteries showed a wide range extending from upper part of L1 vertebra to lower part of the L2 vertebra. RRA in 32% cases arose from LP of L1 vertebra and 32% arose from UP of L2 vertebra, While LRA in

38% cases aroused from LP of L1 vertebra and 32% aroused from UP of L2 vertebra. Renal artery showed a wide range of variation and the results should be kept in mind when a non-invasive diagnostic search is performed for renal artery stenosis, or when renal surgery related to renal arteries is performed.

The vertebral level of origin of main renal arteries showed a wide range extending from upper part of L1 vertebra to lower part of the L2 vertebra.

Vertebral levels of RRAs at L1 LP are (n=16) 32 %, L1 MP are (n=8)16%, L1UP are (n=4) 8% and also L2 UP are (n=16)32%, L2 MP are (n= 5)10%, L2 LP are (n=1) 2% cases.

Vertebral levels of LRAs L1 LP are maximum in (n=19) 38 % cases. Others are L2 UP in (n=16) 32% , L1 MP (n=10)20%, L2 MP (n=3) 6% and L1 UP & L2 LP are (n=1)2% in each cases.

### COMPARISON (SIDEWISE) OF THE VERTEBRAL LEVEL OF ORIGIN OF RENAL ARTERY IN DIFFERENT STUDIES

The RAs may arise from the aorta at a point lower than usual, according to the position of the kidneys, and they also tend to be lower in older persons (7 ).

In a cadaveric study 92% renal arteries are found both sides. (51)

A CT Angiographic study Right and Left renal artery aroused between inter vertebral disc of L1 & L2 are 37% at right side and 38.9% at Left side. (52)

Authors	Type of study	Origin at IVD L1 & L2		in between L1UP to L2LP	
		RIGHT SIDE (in %)	LEFT SIDE (in %)	RIGHT SIDE (in %)	LEFT SIDE (in %)
Ozkan et al (2006)	Conventional Angio	23	22	98	97
Palmieri et al (2011)	CTA	38.8	35.7	94.8	91.4
Parkash et al (2011)	Cadaveric	-	-	92	92
Gumus et al (2012)	CTA	37	38.9	-	-
Anshu Mishra et al (2014)	CTA	24.53	20.75	96.22	96.22
Present Study	CTA	-	-	100	100

**Table 2.3 – Comparative study (sidewise) of the vertebral level of origin of renal artery in different studies**

### CONCLUSION

This study was performed using CT angiography of 100 patients showed that the renal arteries present a broad spectrum of variability in their morphological expression respecting their originating and Moreover, the main renal arteries are arising in between upper part of L1 to the lower part of the L2 vertebrae.

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