

# CT ANGIOGRAPHIC STUDY OF VARIATIONS OF HUMAN RENAL ARTERIES

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## ABSTRACT

The renal artery exhibits a wide spectrum of variations of origin. The renal artery anatomy plays a considerable role in selecting donors. 3-D angiotomography is the best modality for vascular anatomic evaluation. Understanding the position and length of the accessory renal arteries, are advantageous to make use of selective arteriography, arterial embolism therapy and plan stent grafts. Aim of the present study is to determine the variation of accessory renal arteries regarding their number in western U.P population. The data was collected by using CT Scan machine (G.E Optima, 64 channel) with software singo. Sample size- CT angiogram of 50 males and 50 females were included in the study. Inclusion criteria- subjects who were free from renal pathology, Exclusion criteria- Subjects who have renal pathology. Present study reveals that Accessory Renal Artery present in 31% cases, Out of which 21% in males and 10% in females. Male dominance is seen in the prevalence of accessory renal arteries.

**KEY WORDS :** Accessory renal artery, Variation in origin, CT andiography.

## INTRODUCTION

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. In its extrarenal course each renal artery gives off one or more inferior suprarenal arteries, a branch to the ureter and branches which supply perinephric tissue, the renal capsule, and the pelvis. Near the renal hilum, each artery divides into an anterior and a posterior division, and these divide into segmental arteries supplying the renal vascular segments.(1)

Accessory renal arteries are common (30% of individuals), and usually arise from the aorta above or below (most commonly below) the main renal artery and follow it to the renal hilum. They are regarded as persistent embryonic lateral splanchnic arteries. Accessory vessels to the inferior pole cross anterior to the ureter and may, by obstructing the ureter, cause hydronephrosis. Rarely, accessory renal arteries arise from the coeliac or superior mesenteric arteries near the aortic bifurcation or from the common iliac arteries. (1)

## MATERIAL AND METHODS

Aim of the present study is to determine the variations of renal vasculature regarding their number and vertebral level of origin in western U.P population. The data was collected by using CT Scan machine( G.E Optima, 64 channel) with software singo. angiographic data of 100 patients was collected.

**Sample size-** Ct angiograms of 50 male and 50 female subjects were included in the study.

**Inclusion criteria-** Subjects who were free of any signs & symptoms related to kidney pathology

**Exclusion criteria-** Subjects who have Hydronephrosis, Renal calculi, Arterial pathology such as aneurysm or tumours.

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 from *Dr. O. P. Gupta Imaging center, Meerut* .

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.

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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 note the presence of an extra renal artery.

The length of accessory renal artery are electronically measured from origin to termination.(Figure)

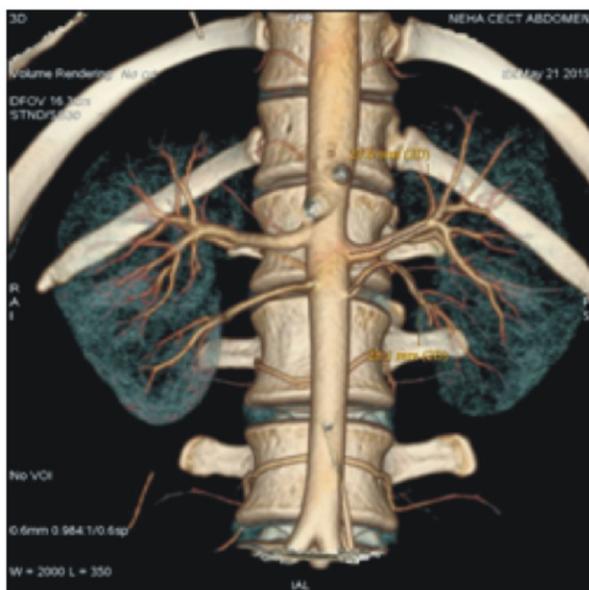


Fig.1:Length of Left accessory renal artery.

### OBSERVATIONS

Accessory renal arteries are present in 31% of cases, Out of which 5% ARAs present on the Rt side, 20% ARAs present on the left side, and 6% bilaterally ( Fig. 1 and Fig.2).

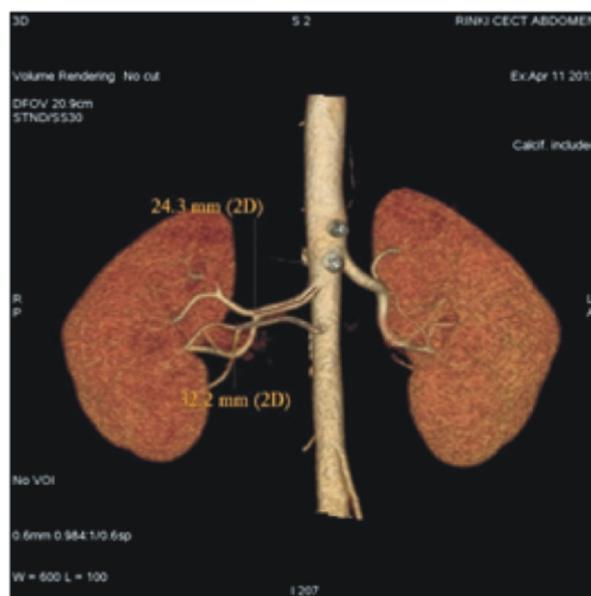


Fig.2: Length of right accessory renal artery.

Right ARA	Left ARA	B/L ARA
5%	20%	6%

Table. 1. Percentage of frequency of Accessory renal arteries

21% accessory renal arteries are present in males and 10% in females.

	RIGHT	LEFT	B/L
MALE	3%	14%	4%
FEMALE	2%	6%	2%

Table. 2- Percentage of frequency of Accessory renal arteries in males and females.

	SEX	N	Length (mm) Mean	Std. Deviation	Std. Error Mean
Length of right accessory renal artery	Male	4	41.575	10.4123	5.2061
	Female	7	39.329	11.7281	4.4328
Length of left accessory renal artery	Male	13	48.369	15.4489	4.2847
	Female	13	12.1712	12.1712	3.3757

Table 3: Length of accessory renal artery.

Author (year)	Population	Type of study	Single(%)	Double (%)	Triple (%)
Khamanarong et al (2004) <sup>3</sup>	Thai	CTA	82	17	1
Ozkan et al (2006) <sup>4</sup>	Turkish	Conventional Angio	74	24	00
Raman et al (2007) <sup>5</sup>	American	64 slice CTA	81	15.9	3.6
Tarzmani et al (2008) <sup>6</sup>	Iranian	64 slice CTA	74.4	22.6	2.1
Saldarriaga et al (2008) <sup>7</sup>	Colombian	Cadaveric	74.9	25.1	00
Ogeno et al (2010) <sup>8</sup>	Kenyan	Cadaveric	71.8	24.8	2.6
Anshu Mishra et al (2014) <sup>9</sup>	Indian	64 slice CTA	83.02	15.09	1.89
Present study	Indian	64 slice CTA	69	31	00

**Table 4 : A comparative incidence of number of renal artery in different population-**

## DISCUSSION

A thorough knowledge of the variations of the renal artery is important with the increasing number of renal transplants. Accurate evaluation of donors in respect to their renal anatomy and its vasculature is an important part of donor screening which helps in planning surgery and avoiding surgery related complications(2). It is especially crucial for the laparoscopic harvest of kidney during which operative visibility and surgical exposure are limited, making details of vessel anatomy difficult to appreciate(2).

More than one renal artery (accessory renal artery) on either side was present in 32% subjects. Out of 106 renal arteries on right side 83.02% of kidneys were irrigated by single renal artery, 15.09% by two renal arteries and 1.89% by three renal arteries<sup>9</sup>.

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<sup>10</sup>.

Except for the main RA, the presence of extra RAs seems to be the most common anatomic variation of these arteries<sup>11</sup>, with an incidence ranging from 8.7% to 75.7%.<sup>6</sup> The presence of an extra RA may exclude the donor or present a challenge for the transplanting surgeons<sup>12</sup>. Extra RA

was found in 14% of all cases in the present study. The RA diameter in kidneys with extra renal artery in the present study was significantly lower than those without an extra R.A. The presence of extra RAs is very probable when the main RA has a diameter of less than 0.42 cm. Kidneys presenting a main RA with diameter greater than 0.55 cm most probably do not present extra RA<sup>13</sup>.

A comparison of kidney side and accessory artery development revealed that an accessory artery occurred significantly more often on the right (32.47%) than on the left side (17.09%)<sup>6</sup>.

In our study we have find 31% (accessory renal artery) on either side. Out of 200 renal arteries, 69% of kidneys were irrigated by single renal artery, 31% by two renal arteries and we have not found any case of three renal arteries .In males, we have found 14% left side, 3% right side and 4% bilaterally while in females 2% Rt side, 6 % in Lt and 2% bilaterally. Male dominance is seen in sexual dimorphism.

## CONCLUSION

Present study reveals that accessory renal artery present in 31 % Of the cases, in which 20% present in left side, 5% right side, 6% bilaterally.

In males, we have found 14% left side, 3% right side and 4% bilaterally while in females 2% Rt side, 6 % in Lt and 2% bilaterally. Male dominance is seen in sexual dimorphism.

Such aspects are important when considering a surgical approach, trauma, interpreting diagnostic images and teaching renal vascularization. The present study adds to the significance and knowledge of surgical anatomy. Understanding the position, calibre, the range of lengths, and the metric relations of the ARAs, were advantageous to make use of selective arteriography, renal transplant, arterial embolism therapy and plan stent grafts.

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