



Variations Of Renal Artery And Its Clinical Significance In South Indian Population

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Abstract

Background

Normally both kidneys are supplied by a pair of renal arteries which arises from abdominal aorta at the level of intervertebral disc between L1 and L2 vertebrae. Presence of additional renal arteries are most frequent variation which is to be considered while doing the interventional radiological procedures, renal surgeries & renal transplantation. Our purpose of the study is to observe the presence or absence of accessory renal artery, their number, side of origin presence or absence of extrarenal branches.

Materials And Method

The cross-sectional study was conducted in 50 cadaver (25 male & 25 female) fixed in a formalin which were allotted for undergraduate teaching in the Department of Anatomy, Kanyakumari Govt Medical college, Tamilnadu, South India during the year 2018- 2021. The kidneys with the variation of renal artery renal veins were removed along with the part of abdominal aorta and Inferior vena cava. The presence of variation of accessory renal arteries and branches to extrarenal part were noted.

Result

Variations noted in 22 cadavers (44%). Bilateral variations-12% triple renal arteries on left side and in right side- 16% suprarenal artery and renal artery arose as a common trunk from abdominal aorta. Unilateral double renal arteries were present on left side in 20% and right side in 8%. Branches to suprarenal gland from left aberrant renal artery seen in 4%. Right inferior phrenic artery arose from right upper renal artery in 6%.

Conclusion

Awareness of such variant is important while doing investigational and surgical procedures related to kidney.

Keywords: accessory renal artery, kidney, renal artery, variant

Introduction

Renal arteries are the pair of lateral branches arising from abdominal aorta below the level of superior mesenteric artery at the level between L1 and L2 vertebra^[1,2]. Each artery carries about 20% of cardiac output to kidneys. Right renal artery is longer and often higher and passes posterior to inferior vena cava. Left renal artery is little lower and passes behind left renal vein. Each renal artery divides into anterior and posterior divisions at or very close to the

hilum of the kidney. Then it gives segmental arteries to supply each segment of kidney and continues as end arteries. Variants in number, side of origin, course, caliber, obliquity, their precise relations and extrarenal branches to other structures are very common. There is a different terminologies namely aberrant and accessory renal artery. Accessory renal artery is one that is accessory to the main artery passing towards the hilum and enter the kidney whereas aberrant is one, which supplies the kidney

IPA – Inferior Phrenic Artery RA – Renal artery AA – Abdominal Aorta

without entering the hilum^[1]. Accessory renal artery usually arises from abdominal aorta above or below the main renal artery. In 70% of individuals each kidney is supplied by single renal artery^[1]. Multiple renal arteries are unilateral in 30% and bilateral in approximately in 10% of the individual.

Different origin of renal arteries explained by the embryonic development of mesonephric arteries^[3]. These arteries supplying the kidneys, suprarenal and gonads form a vascular network on both side of aorta between lower cervical and upper three lumbar vertebrae, a region known as rete arteriosum urogenitale^[4]. Later these arteries getting degenerated and leaving behind one mesonephric artery. Deficiency in the development of mesonephric arteries results in more than one renal artery.

Renal artery variants should be kept in mind to avoid complication like bleeding during vascular ligation, diagnostic angiography and radiological procedures. Sound knowledge of occurrence of variants in their number, origin, extrarenal branches to other structure is very essential while performing surgical procedures including transplantation of kidney. The present study is focused on the incidence of renal artery variants and compare our study with other studies and their clinical importance.

Aim Of The Study:

1. To study the presence or absence of accessory renal artery
2. To study unilateral or bilateral variants
3. To study the number and side of origin of accessory renal artery
4. To study the extra renal branches

Methods And Materials

A Cross Sectional Study was conducted in 50 embalmed cadavers irrespective of sex, donated for study and research purpose of first year MBBS students in the Department of Anatomy, Kanyakumari Government Medical College Asaripallam, Tamil Nadu, India from the year 2018-2021. There was no ethical issues. The routine dissection of abdomen was done. Anterior abdominal

wall was opened and kidneys were exposed as per the guidelines given in the Cunningham's Manual of Practical Anatomy^[5]. Kidneys along with part of abdominal aorta, inferior vena cava and renal arteries were removed and studied. Number, source, side of origin and extrarenal branches of renal arteries to other structures were traced. The findings were photographed and data were tabulated in percentage.

Results

Presence or absence of variants of renal artery:

In our study renal artery variants were present in 22 cadavers out of 50 (44%). In 28 cadavers (56%) absence of variants (Table 1)

Incidence of bilateral and unilateral variants:

In the present study bilateral variants- triple renal arteries on left side in 6 cadavers (12%) (Table 1 and Fig 1) and suprarenal artery and right renal artery arose as a common trunk from abdominal aorta on right side in 8 cadavers (16%) (Table 1, 2 and Fig 1, 2) were present. Unilateral double renal arteries were present on left side in 10 cadavers (20%) (Table 1, 2 Fig 2 and Fig 3) and right side in 4 cadavers (8%) (Table 1 and Fig 4).

Incidence of number and side of origin of accessory renal artery:

Double renal arteries were present in right side in 4 cadavers (8%) (Table 1, 2 and Fig 3) and left side in 10 cadavers (20%) (Table 1, 2 and Fig 2, 3)

Incidence of variants in extra renal branches:

Branches to suprarenal gland:

In our study in 3 cadavers (6%) supra renal artery and renal artery arose as a common trunk from abdominal aorta in right side (Table 3 and Fig 1, 2). In left side two supra renal arteries arose from left aberrant renal artery in 2 cadavers (4%) (Table 3 and Fig 2)

Branches to diaphragm:

In 3 cadavers (6%) right inferior phrenic artery arose from right upper renal artery (Table 3 and Fig 4)

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Fig 1: Bilateral renal artery variation

1, 2, 3 – Upper, Middle, Lower renal arteries. RA – Renal Artery AA – Abdominal Aorta IVC – Inferior Vena Cava

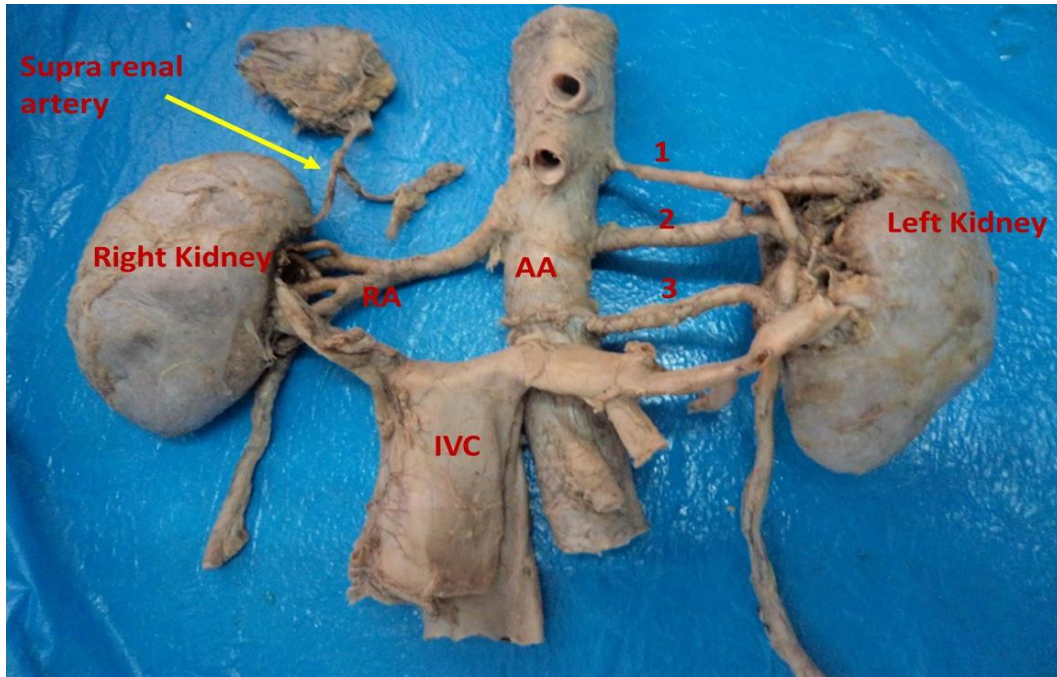
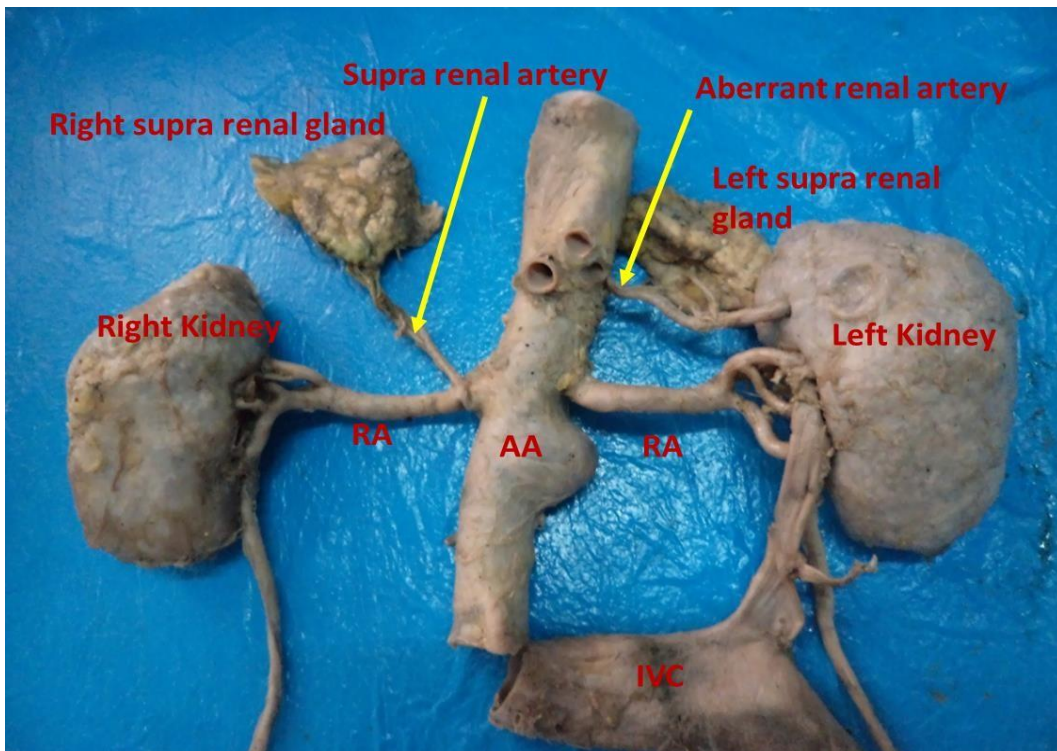


Fig 2: Unilateral Double Renal Artery

RA – Renal Artery AA – Abdominal Aorta IVC – Inferior Vena Cava



IPA – Inferior Phrenic Artery RA – Renal artery AA – Abdominal Aorta

Fig 3: Unilateral Double Renal Artery

RA – Renal Artery AA – Abdominal Aorta IVC – Inferior Vena Cava

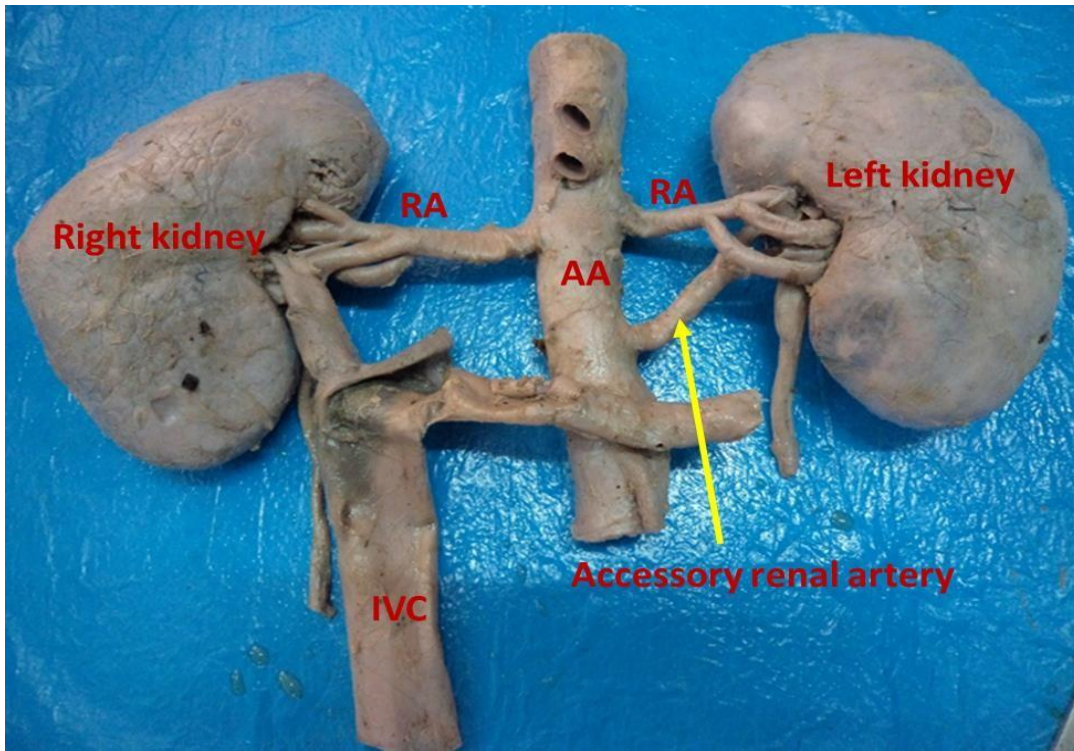
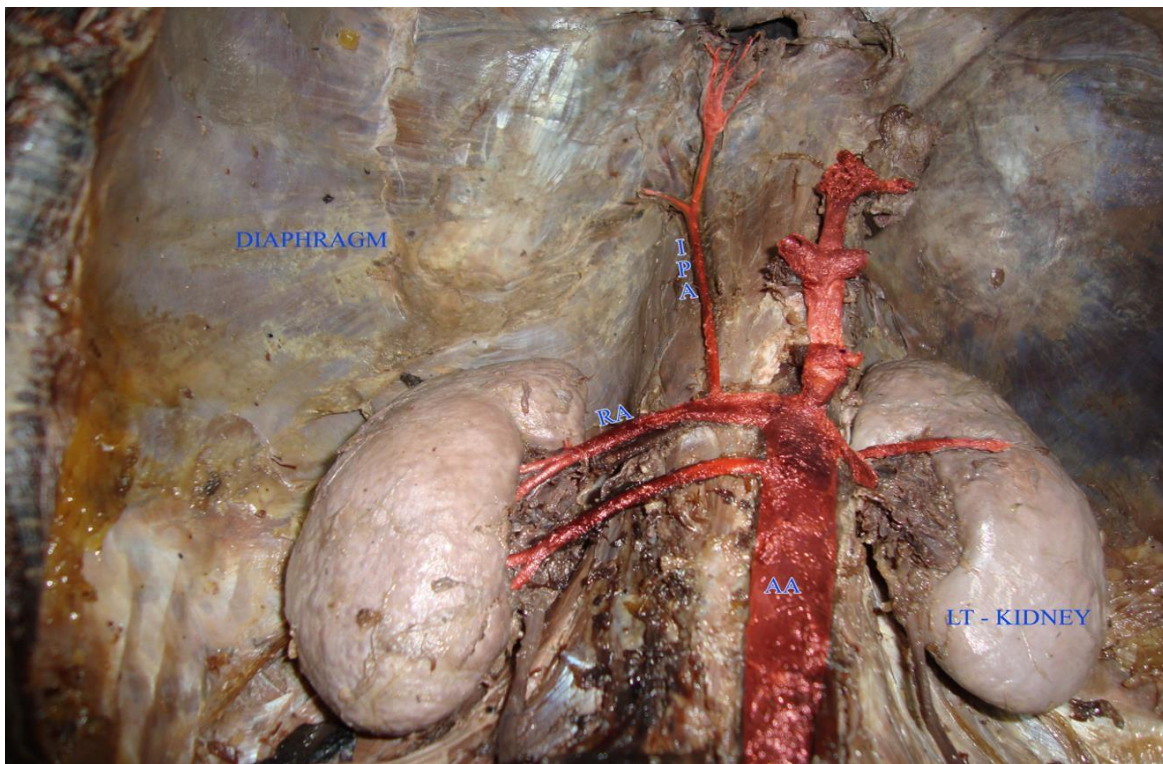


Fig 4: Unilateral Double Renal Artery with Right Inferior Phrenic Artery arising from Upper Right Renal artery



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TABLE 1: Incidence of number and side of origin of Accessory renal arteries

S.No.	Variations of renal artery		Double Renal artery		Triple Renal artery	
	Present	Absent	Right	Left	Right	Left
1	22 (44%)	28 (56%)	4(8%)	10(20%)	-	6(12%)

TABLE 2: Incidence of extrarenal branches

S.No.	Extrarenal branches				
	Branches to suprarenal gland		Branches to Diaphragm		
1			Left		Left
	Right			Right	
	3(6%)		2(4%)	3(6%)	-

TABLE 3: Incidence of Accessory renal arteries

S.No.	Name of the study	Year of study	Double	Triple
1	Vilhova(7)	2001	-	25-30%
2	Budhiraja(10)	2013	-	11.8%
3	Brodei(9)	2004	20%	-
4	Dhal &Lal(12)	2005	20%	-
5	Present study	2022	20%	12%

TABLE 4: Incidence of Extrarenal Branches in different studies

S.No.	Name of the study	Year of study	Extrarenal branches (%)
1	Like Ali Gurses(14)	2009	15%
2	Gokan(15)	2001	9%
3	Piao(16)	1998	4.3%
4	Present study	2022	6%

Discussion

Presence or absence of variants of renal artery:

In the present study, in 28 cadavers (56%) both kidneys were supplied by single renal artery without any variants. (Table 1). According to Gray, kidneys are supplied by single renal artery in 70% of population^[1]. In a study by Dhar P, Lal K in forty cadavers revealed a single main renal artery on either side in 80% of the specimens and 62.9% in the study by B.Saldarriaga et al.^[6]. Our results were lower than that of above studies. (Table 1)

Incidence of bilateral and unilateral variants:

In our study bilateral variants- triple renal arteries on left side in 6 cadavers (12%) (Table 1 and Fig 1) and suprarenal artery and right renal artery arose as a common trunk from abdominal aorta on right side in 8 cadavers (16%) (Table 2, 3 and Fig 1) were present. In a study by Budhiraja, Rastogi R et al^[7] of the 54 cases, 42 were unilateral, showing a left predominance (25 cases), three of them with triple renal arteries on the opposite side. In six cases they encountered bilateral double renal arteries.

Incidence of number and side of origin of accessory renal artery:

In our study, double renal arteries were present in right side in 4 cadavers (8%) (Table 1, 2 and Fig 4). B.Saldarriaga et al and Budhiraja, Rakhi Rastogi, A. K. Asthan et al^[8] reported 43.7% and 62.5% double renal arteries in right side respectively. (Table 4) Neelesh found double accessory right renal arteries in one specimen^[9]. Our study is more than that of Neelesh et al study and lesser than that of B.Saldarriaga et al^[6] and Budhiraja et al^[7] in the present study, double renal arteries were present in left side in 10 cadavers (20%) (Table 1, 2 and Fig 2, 3). In the study by Brodei^[10] of 272 kidney, 54 (20%) double renal arteries originating from aorta. Of the 54 cases, 42 were unilateral, showing a left predominance (25 cases) (Table 3). Vilhova^[11] reported the presence of multiple renal arteries in 25-30% mostly on the left side (Table 4). Sathyapal^[12] noticed high frequency of additional renal arteries for the left kidney. The present study also shows high incidence of additional renal arteries on left side. But in a study by Budhiraja, Rakhi Rastogi,

A. K. Asthan et al^[7] high incidence of double renal arteries on the right side 62.5% and left side 37.5% (Table 3). This study is different from above mentioned studies. Dhar and Lal^[13] noted the presence of double renal arteries as 20%.

Incidence of variants in extra renal branches:

Like Ali Gurses^[14] noticed the upper renal artery gave two supra renal branches in 15%. In our study, 6% of upper renal artery (aberrant renal artery) gave two branches to suprarenal gland. It is lower than their study. (Table 4) GokanT et al^[15] reported right inferior phrenic artery arising from right renal artery in 9% of cases. Piao Dx et al^[16] stated that 4.3% of 68 Japanese cadavers, right inferior phrenic artery arose from right renal artery. In our study in 6% of specimen right inferior phrenic artery arose from right renal artery. Our study report is lower than the study by Gokan and higher than that of Piao's study (Table 4). Faria^[17] reported right inferior phrenic artery is a branch of right renal artery involved in many diseases especially in hepatocellular carcinoma, which is a highly malignant hepatic cell tumor since this vessel is mainly responsible for collateral supply to these type of tumor.

Conclusion

Variations in blood vessels are common and a sound knowledge of these variations is important for diagnosing and performing abdominal surgeries. It is essential to know the variable renal vasculature prior to renal transplant to avoid complications. With increase in the incidence of multiple renal arteries, clinicians should be more aware of such renal anomalies while doing laparoscopic surgeries and renal transplantation, renal artery embolization, angioplasty and vascular reconstruction and surgery for aneurysms of abdominal aorta. Anatomical knowledge of such anomalies is more useful for surgical as well as radiological procedures that helps in reduction in the risk of trauma to the vessels.

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