IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 4 Ver. 18 (April. 2018), PP 59-66
www.iosrjournals.org

Anomalous Branching Pattern Of Renal Artery: A Cadaveric Study.

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Abstract:
Objective: *The aim of this study was to detect and describe the existence and incidence of anatomical variations of the renal artery by using dissection technique.*
Materials and Methods: *40 cadavers dissected, Department of anatomy S.M.S. Medical College, Jaipur.*
Results:
We found that 45% cadavers had classical (Normal) anatomical presentation of Renal artery, whereas in 55% cadavers, variations existed in the same, using cadaveric method.
Conclusion:
A thorough knowledge of the variations in renal arteries has gained a lot of importance with the increasing number of renal transplants and other uroradiological procedures. The arterial variations should not be ignored. With an accurate knowledge on the anatomical variations, many operative and post operative complications can be avoided.
Keywords: *Hilar renal artery, renal transplant, supernumerary renal artery, Accessory renal artery, polar renal artery.*

Date of Submission: 16-04-2018 Date of acceptance: 04-05-2018

I Introduction

Normally aorta gives rise to a single renal artery on each side which supplies respective kidneys. The kidneys are one of the vital organs in the human body. It receives rich blood supply, nearly 25% of the cardiac output pass through the renal arteries to be filtered by the kidneys. Normal anatomy describes each kidney receives irrigation from single renal artery which arises from abdominal aorta at the level L1-L2 vertebrae just below the superior mesenteric artery. Renal artery variations include their origin, number and course, the most common is the presence of additional vessels (accessory arteries) arising above the usual trunk is more frequent than one arising below. Variant arteries have been called accessory, supplementary, aberrant or supernumerary arteries [1].

All these variations have embryological origin. During development, each primitive dorsal aorta gives off splanchnic arteries which divides in to somatic ,ventral and lateral groups. Emryologically renal arteries developed from Lateral splanchnic arteries[2].

Current Literature reports great variability in renal blood supply, the number of renal arteries mentioned being the most frequently found variation. Unusual vascular patterns are the most often encountered variations among renal

morphological variations. Renal vessels, especially arteries, exhibit a high degree of variation. . The presence of unusual branching patterns of the renal arteries is not uncommon.

Common variations of renal artery are it's variable number and unusual branching pattern. Supernumerary arteries have been classified into Hilar or polar arteries. Renal artery variations are becoming more important due to the gradual increase in interventional radiological procedures, urological and vascular operations, and renal transplantation. [3]

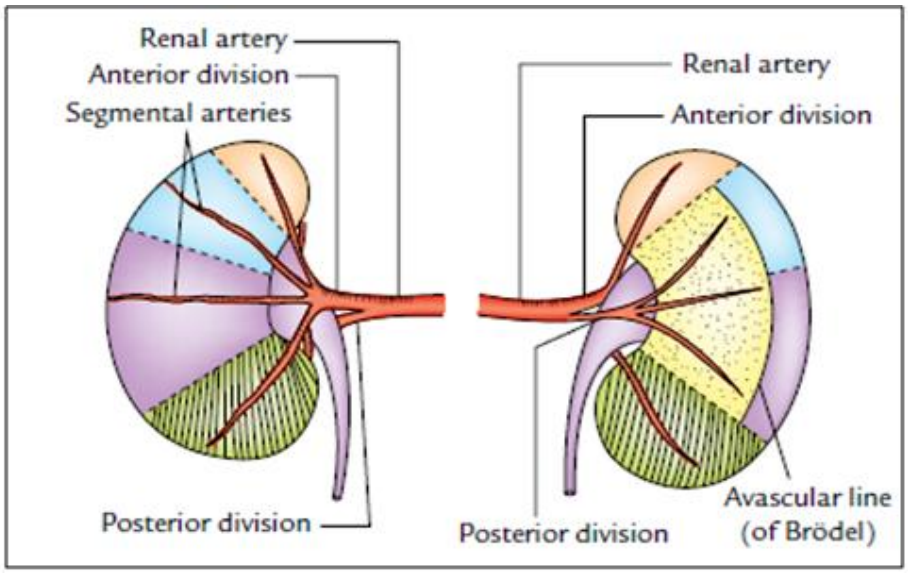


Figure 1.Branches of renal artery

II Materials And Methods

Total 40 formalin (38%) fixed cadavers irrespective of gender, constituted the material for the study. During routine abdominal dissection practices for undergraduates in the dissection hall of S.M.S. Medical College, Jaipur .

Instruments used were-

- Scissors (pointed, blunt, curved, 4" and 6" size)
- Scalpel (blade no. 23)
- Forceps (plane and tooth)
- Thread
- Divider

STEP 1-A vertical incision was given from xiphoid process to pubic symphysis. One horizontal incision was given from xiphoid process laterally to the body. Another horizontal incision was given from pubic symphysis to iliac crest. Skin flaps were reflected laterally. Anterior abdominal wall muscles, rectus muscles and their aponeurosis were identified and reflected. Abdominal cavity was opened by reflecting the peritoneum.
STEP 2- Greater omentum was identified and it was reflected. Duodenum and Pancreas were reflected. Small intestines were turned to left. Fat and fascia from the anterior surface of left kidney and suprarenal gland were exposed and were removed. The left Suprarenal vein and the Testicular vein/ Ovarian vein were traced to left renal vein.
STEP 3- Renal vein was displaced to expose the left renal artery. Its branches to left suprarenal gland and ureter were identified. Left kidney was turned medially to expose its posterior surface and there relation of posterior surface of kidney were studied.
Similar procedure was carried out on the right side to expose the right kidney.

III Discussion

Normally the renal arteries arise from the abdominal aorta at the L1-2 vertebral body level, inferior to the origin of the superior mesenteric artery.

According to Dhar and Lal [4], accessory renal arteries were observed unilateral in 15% cases and bilateral on 5% of cases. In present study, it (accessory renal arteries) was 27.5%. As per Lee Mc Gregor's synopsis of surgical anatomy, there is more than one renal artery in 15-20% of cases on the right and left sides respectively [3]. In present study, there is more than one renal artery in 7.5%. cadavers.

According to present study, we found presence of polar arteries (superior and inferior polar) in 10% cadavers , Sampaio *et al.,* observed superior polar artery origin from the aorta in 6.8% of kidneys[5]. Bordei *et al.,* reported that in 5 out of 54 cases (9.25%)[6].

Presence of abberent renal arteries in present study was 5%.

Embryologically development of kidney is very complex, as it develops from pronephros, mesonephros and metanephros. The former two regresses but the arterial network to these segments may remain and lead to supernumerary renal arteries (two or more arteries to a single kidney) [7].

For performing surgeries on the renal area, morphology of the renal vessels is of special significance, since variations and anomalies may strongly influence the technical feasibility of the operation Each kidney is supplied by one renal artery arising from the abdominal aorta, but in approximately 30% of individuals, more than one artery can be present.[8] Laproscopic surgical procedure requires knowledge of additional renal vessels in order to avoid complications like complete necrosis of a particular segment of the kidney [9]. Possibilities of additional vessels should also be kept in mind while performing noninvasive diagnostic procedures. The additional vessels may lead to alarming hemorrhage if unnoticed during total Nephrectomy [10] .

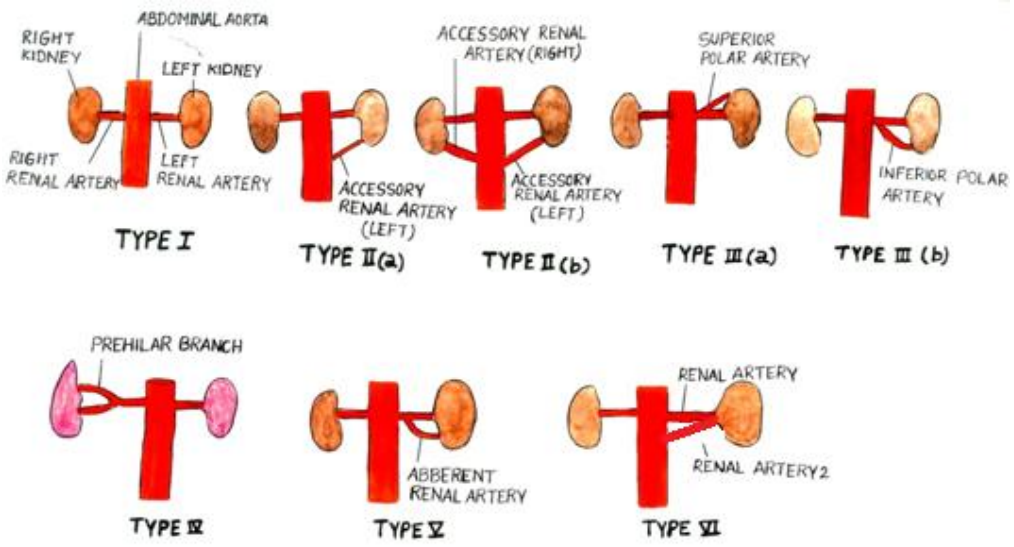


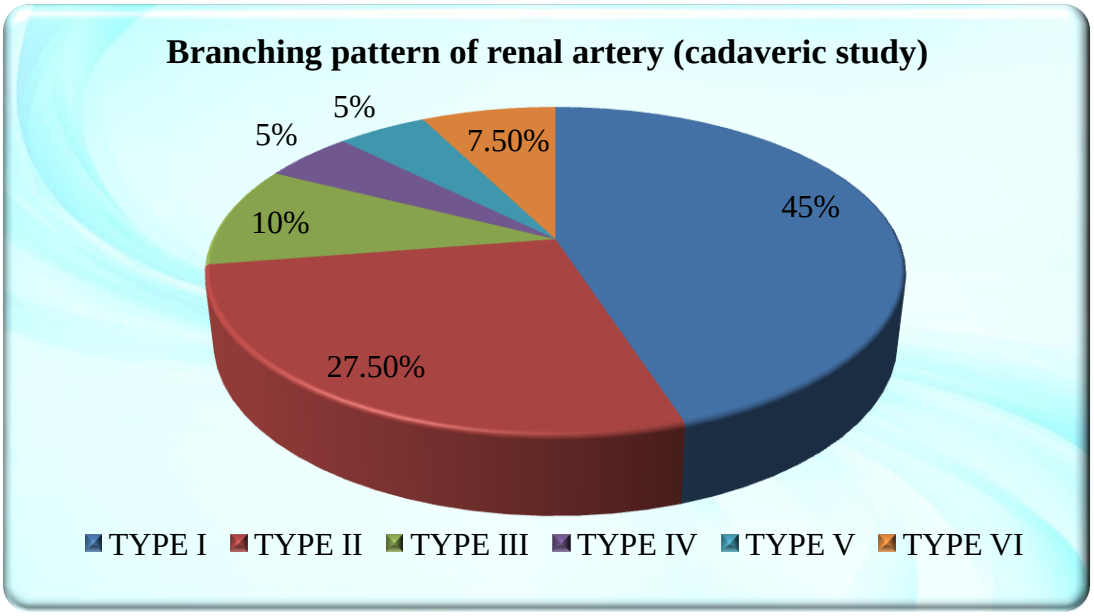
Figure 2 .Diagrammatic representation of branching pattern of renal arteries [according to present study]

IV Observation

Study conducted on total 40 cadavers, it is found that 18 cadavers i.e. 45% , were having normal branching pattern (**fig.1**) , 11 cadavers i.e. 27.5% presence of accessory renal artery **(fig.2.1, 2.2**), there is presence of extrapolar branches in 4 cadavers i.e. 10% **(fig.3.1, 3.2)** , presence of prehilar branches in 2 cadavers i.e. 5 % **(fig.4),** 2 cadavers having aberrant renal arteries i.e.5% **(fig.5)** and 3 cadavers having double renal arteries i.e. 7.5% **(fig.6).**

BRANCHING PATTERN	**MALE**		**FEMALE**		**TOTAL**	
	No	**%**	**No**	**%**	**No**	**%**
Type I	15	50	3	30	18	45
Type II	8	26.67	3	30	11	27.5
Type III	3	10	1	10	4	10
Type IV	1	3.34	1	10	2	5
Type V	2	6.67	0	0	2	5
Type VI	1	3.34	2	20	3	7.5
Total	30	100	10	100	40	100

Table No.1 - Branching pattern of renal artery in males and females according to cadaveric group



Type I - Normal Pattern
Type II - Presence of Accessory Renal Artery
A] Unilateral
B] Bilateral
Type III- Presence of Extrapolar branches
A] Upper polar
B]Lower polar
Type IV Presence of Prehilar branches
Type V - Presence of Aberrant Renal Artery
Type VI Presence of Double Renal Artery

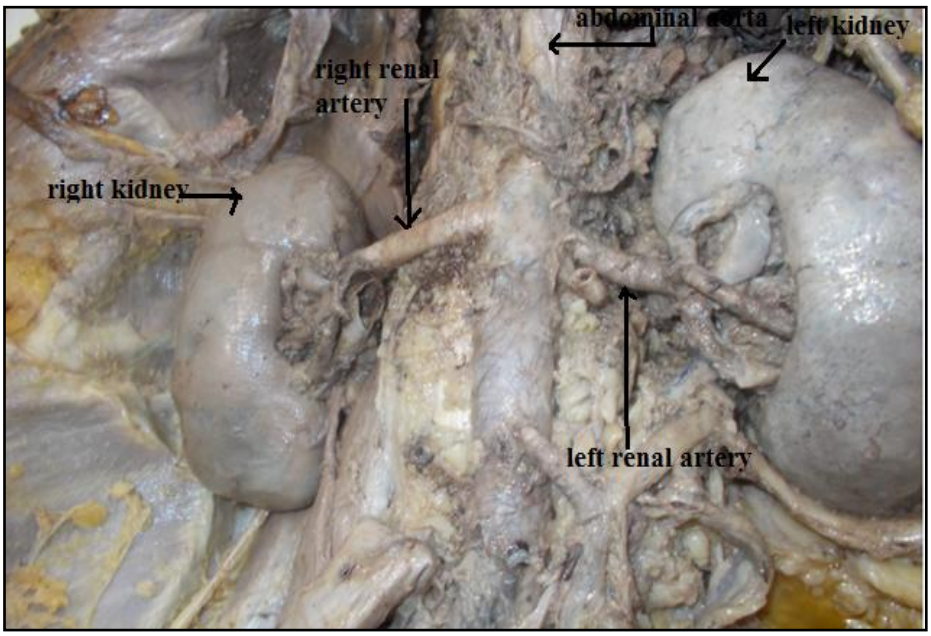


Figure 1.-(TYPE I) Normal pattern of Renal Artery

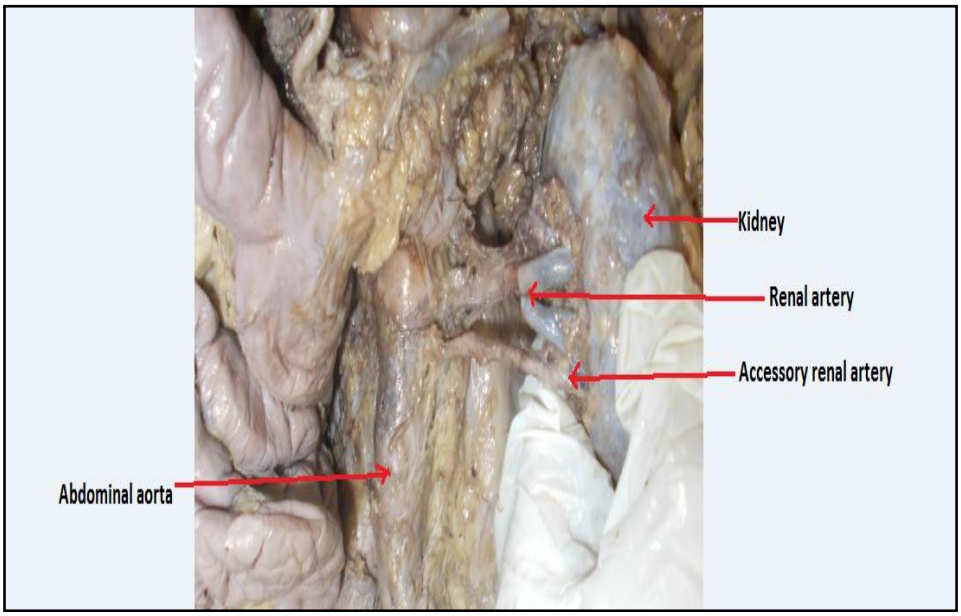


Figure 2.1-TYPE II (A) Presence of unilateral (left) Accessory Renal Artery

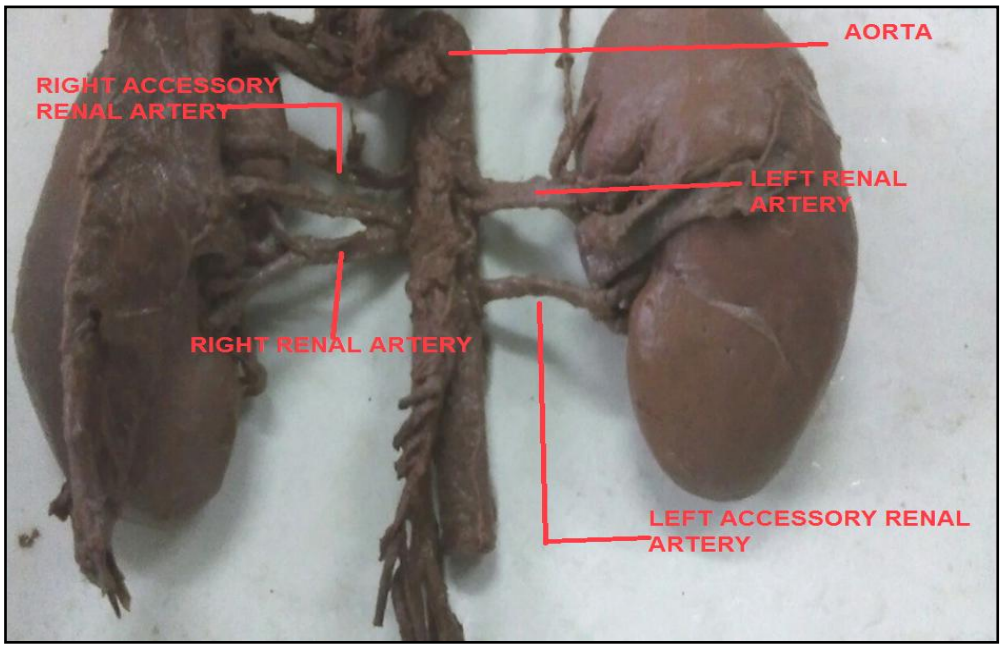


Figure 2.2-TYPE II (B) Presence of bilateral Accessory Renal Artery

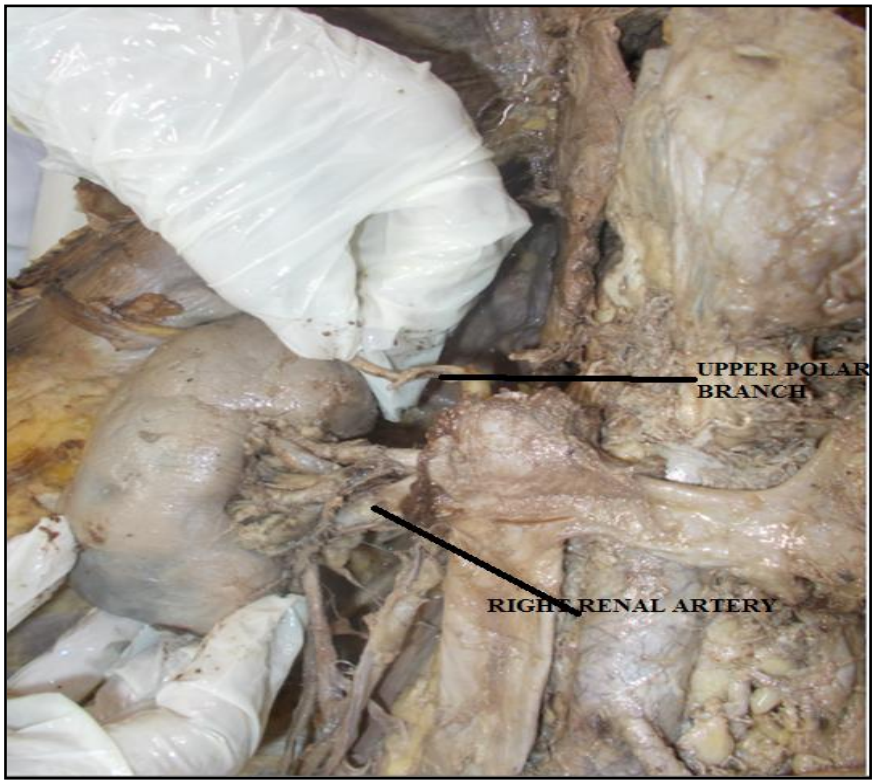


Figure 3 .1(A) Presence of Extra polar branch (superior polar)

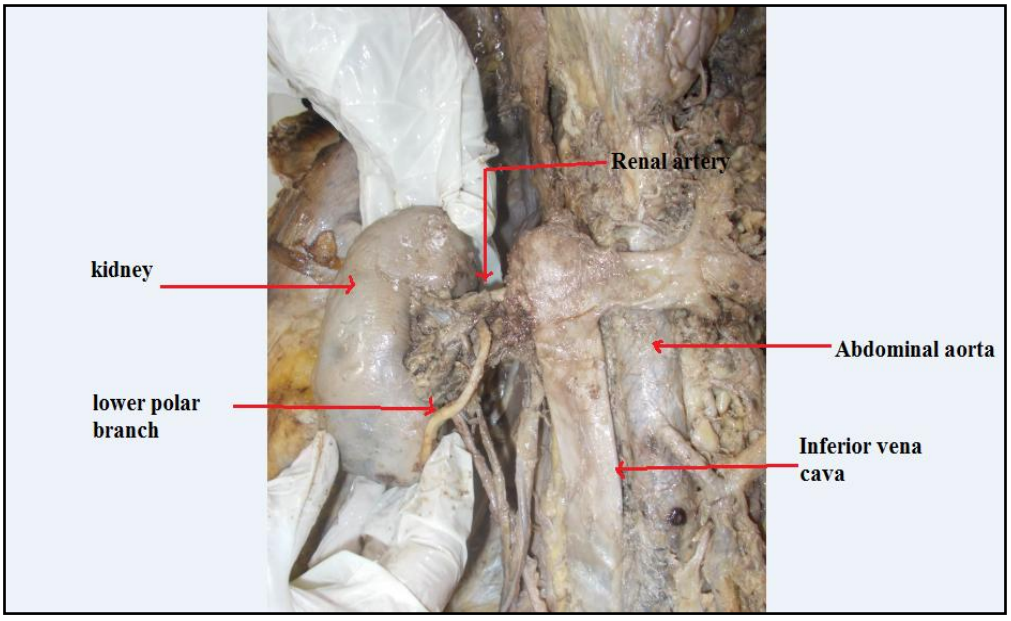


Figure 3.2-TYPE III (B) Presence of Extra polar branch (inferior polar)

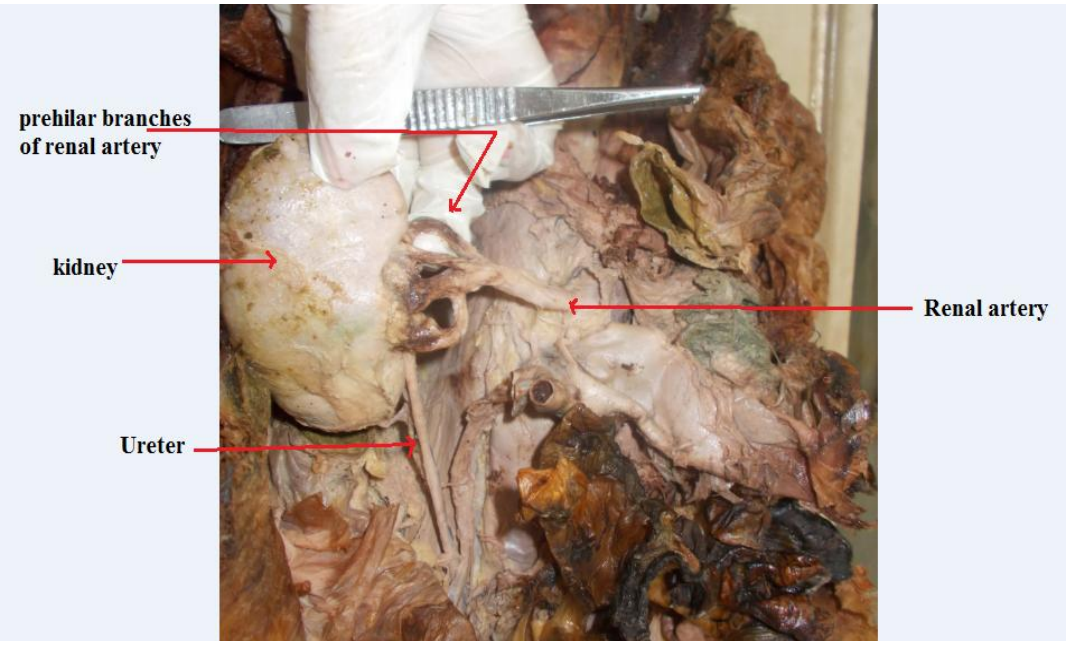


Figure 4-TYPE IV Presence of Prehilar Branches

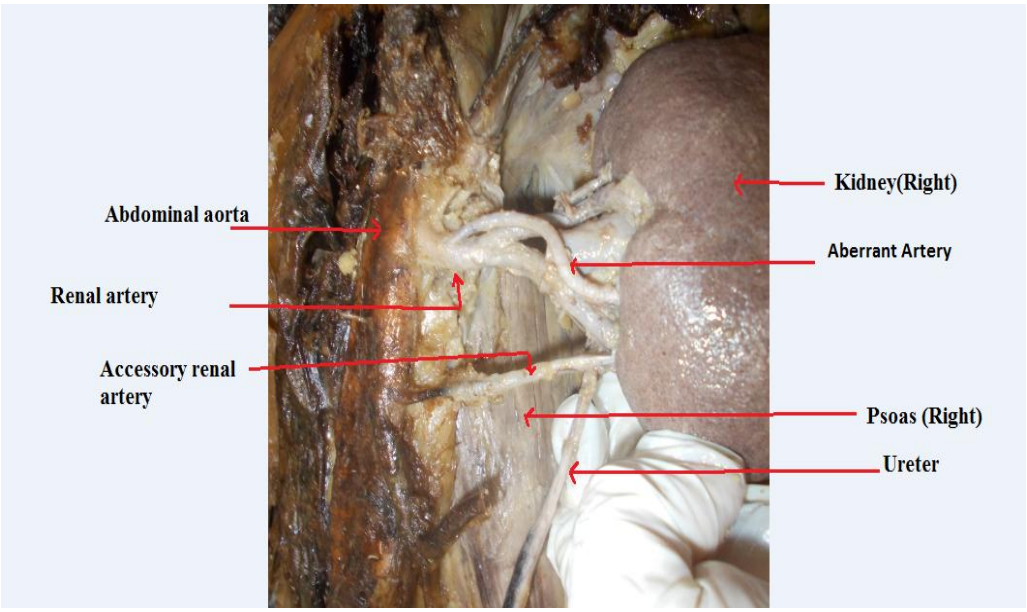


Figure 5 -TYPE V Presence of Aberrant Renal Artery

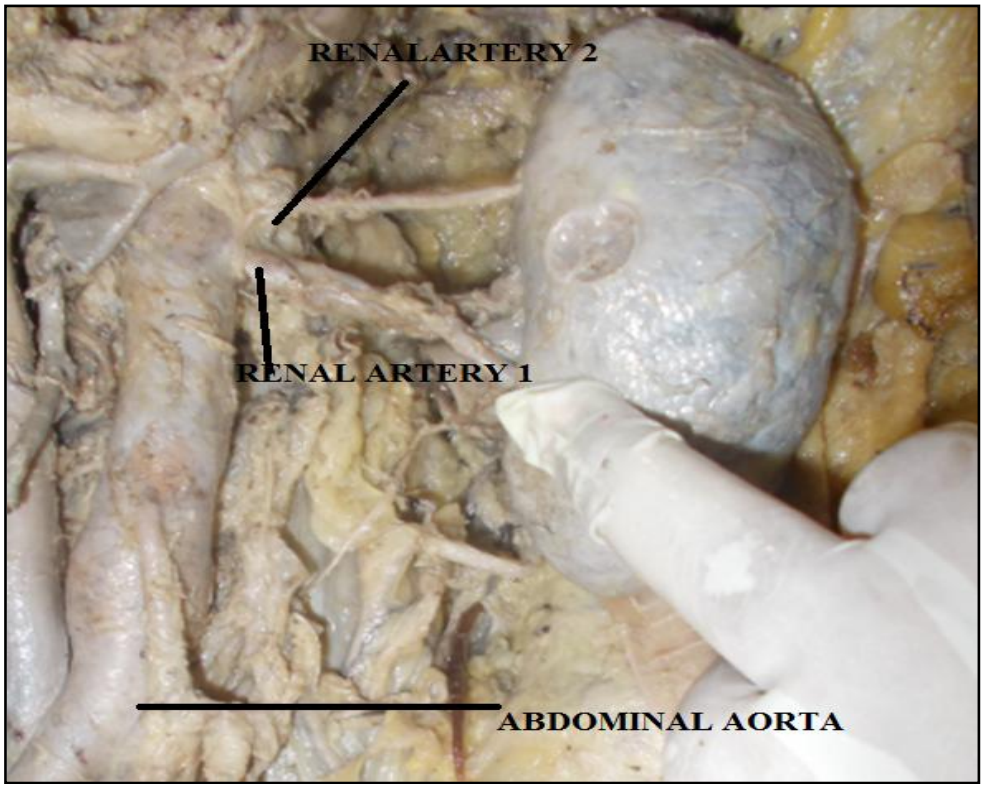


Figure 6-TYPE VI Presence of Double Renal Artery.

V Conclusion

Anatomical variations in the origin of the renal arteries may have importance for the urologists while performing nephron-preserving surgery, and the management of renal vascular hypertension. A thorough knowledge of variations in branching pattern of renal arteries has grown in importance with the increasing number of renal transplants and other uroradiological procedures. Normal renal arterial information is useful not only for planning but also for performing endovascular, laparoscopic uroradiological procedures and renal transplants, in order to facilitate the clinical approaches.

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Dr. Olive Singh." Anomalous Branching Pattern Of Renal Artery : A Cadaveric Study.."IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 4, 2018, pp 59-66.