

## Accessory Renal Arteries: A Cadaveric Study

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### ABSTRACT:

**Objectives:** Renal arteries normally arise from the abdominal aorta at the level L1 vertebra. Accessory renal arteries were arising from abdominal aorta below the normal renal artery. Understanding anatomy of the vascular variation of kidney is essential for the clinician to perform procedures such as renal transplantation, interventional radiological procedures and renal vascular operations more safely and efficiently. No medical history of the cadaver was available to corroborate the clinical findings. The aim of the study was to establish the incidence and characteristics of accessory arteries in human kidneys. **Methods:** The present study was conducted on formalin fixed thirty two cadavers (irrespective of sex) during routine dissection of abdomen by the undergraduate medical students from the department of anatomy, B.J.Medical College, Ahmedabad, Gujarat. **Results:** In present study we found accessory arteries were seen in three kidneys .All were arising from the abdominal aorta below the normal renal artery. These were more common on the left side and at the lower pole. The artery cranial to the normal renal artery entered the anterior aspect of the kidney 4 cm below the upper pole. Two accessory arteries were seen in one kidney on right side which is cranial & caudal to normal renal artery at the distance of 1.6 cm & 3.9 cm from lower part of hilum respectively. **Conclusion:** Knowledge of the variations in the renal arteries is important for urologists, radiologists and surgeons in general. It is of great importance in performing operations like segmental resections, partial nephrectomy, and renal transplantation

**Keywords:** Accessory renal arteries, Kidney, Renal artery, Renal transplant.

### Introduction:

Each kidney is supplied by a single renal artery. Which arise as a lateral branch of abdominal aorta, between the levels of L1 and L2.<sup>2</sup> The right renal artery is longer and often higher, passing posterior to the inferior vena cava, right renal vein, head of the pancreas, and descending part of the duodenum. The left renal artery is a little lower and passes behind the left renal vein, the body of the pancreas and splenic vein<sup>4</sup>. It may be crossed anteriorly by the inferior mesenteric vein. the hilum each artery divides in to a posterior division that supplies the posterior segment and an anterior division that further branches and supplies apical, upper, middle and lower segments. This standard pattern is sometimes modified due to the difference in the



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branching pattern. However five segments are always present and there is no collateral circulation between these segments.<sup>12</sup> Accessory

artery is the precocious origin of a segmental artery which sometimes arises from aorta and supplies upper or lower pole of the kidney. The accessory artery is a remnant of degenerated mesonephric artery. the artery for the lower pole usually passes behind the pelvis of ureter, causes obstruction to the flow of urine producing hydronephrosis<sup>1</sup> It is important to be aware that accessory renal arteries are end arteries; consequently if an accessory renal artery is damaged or ligated, the part of the kidney supplied by it is likely to become ischemic. Accessory renal arteries are about twice as common as accessory veins.<sup>8</sup> An incidence of 30% certainly warrants proper understanding of its anatomy and clinical significance as the success of the renal transplant depends on immunological acceptance and perfect vascularisation of the grafted kidney. Knowledge and awareness of these possible variations and anomalies of renal arteries are necessary for sufficient surgical management during renal transplantation, repair of abdominal aorta aneurysm, urological procedures and angiographic interventions.<sup>10, 11</sup>

### Material and Methods:

The formalin fixed thirty two cadavers (irrespective of sex) constituted the material for study. During routine abdominal dissection conducted for medical undergraduate students at Department of Anatomy, kidneys along with their arteries were explored and the morphological variations of renal arteries were noted. During the course of dissection various abdominal viscera were removed and preserved as specimen for teaching purposes.

### Results:

All accessory arteries were arising from the abdominal Aorta below the normal renal artery. One accessory artery was seen in 2/32 kidneys which is lies 4 cm below the upper pole which is common at lower pole on left side.

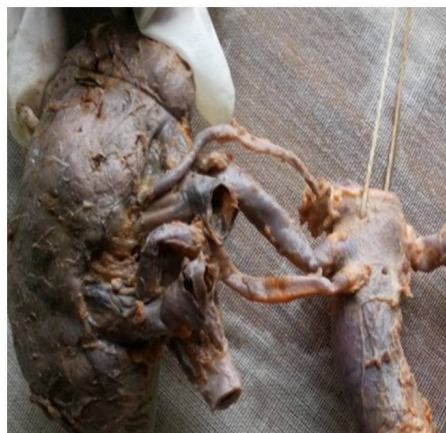
Two accessory arteries were seen in 1/32 kidney, at both upper and lower poles it was seen in one kidney on right side, this accessory artery is cranial & caudal to normal renal artery at the distance of 1.6 cm & 3.9 cm from lower part of hilum respectively.

**Image 1- Accessory renal artery at lower pole on left side**



**Image 2- Accessory renal artery**



**Image 3: Accessory renal artery at both upper & lower pole****Discussion:**

Most of the abnormalities of renal artery are due to changing position of kidney as a part of its normal development and ascent<sup>15</sup>. The kidney begins their development in pelvic cavity. During further development they ascend to lumbar region which is their final position. When they are in pelvic cavity they are supplied by internal iliac artery or common iliac artery. While the kidney ascends to lumbar region their arterial supply also shifts from common iliac to abdominal aorta<sup>9</sup> Embryological explanation of these variations has been presented and discussed by Felix (1912) In an 18 mm fetus, the developing mesonephros, metanephros, suprarenal glands and gonads are supplied by nine pairs of lateral mesonephric arteries arising from the dorsal aorta.. Felix divided these arteries into three groups as follows: the 1<sup>st</sup> and 2<sup>nd</sup> arteries as the cranial group, the 3<sup>rd</sup> to 5<sup>th</sup> arteries as the middle group and 6<sup>th</sup> to 9<sup>th</sup> arteries as the caudal group. The middle group gives rise to renal arteries. Persistence of more than one renal arteries of the middle group results as multiple renal arteries. Thus, the duplicated renal arteries in our study are a result of two persisting lateral mesonephric arteries from the middle group. Accessory renal arteries are found frequently on the left side and occurrence is as high as 30–35% of cases, these arteries usually enter the upper or lower poles of the kidney<sup>14</sup> In the present study, we found accessory renal arteries on left side entering the inferior pole as inferior polar arteries. The renal arteries originate from the abdominal aorta and account for 20% of the cardiac output to the kidneys. The renal vascular segmentation was discovered by John Hunter in 1794, but a detailed account was given in 1950's by corrosion cast studies.<sup>13</sup> The knowledge of this potential anomaly is important for surgical procedures related to posterior abdominal wall such as renal transplantation, abdominal aorta aneurysm, ureter surgery and angiographic interventions. Every multiple renal artery is likened to segmental artery so the risk of bleeding during urological surgery or renal transplantation, segmental ischemia and post operative hypertension increases, if the urologist is unaware of its existence<sup>3</sup> Surgeons performing renal transplant need to have prior anatomical knowledge of normal renal vasculature and also accessory renal arteries in order to perform successful graft.. It has been described that failure to restore circulation in accessory renal artery after surgery may cause unnecessary ischemia or necrosis of renal tissue<sup>5</sup> Thus knowledge of

embryology of renal vasculature and its development is essential in order to understand the possibilities of multiple anomalies and variations in renal arteries. K S Satyapal found that out of 130 renal angiograms and 32 cadavers, kidneys showed presence of one additional renal artery in 23.2% and two additional renal arteries in 4.5%. They were seen more commonly on left side 32% as compared to 23.3 % on right side. Presence of one additional renal artery was seen bilaterally in 10.2%<sup>7</sup> There are five defined arterial segments: apical, superior, middle, inferior and the posterior. The anatomical knowledge of these segments is important while performing nephrectomies. We compared our results with previous studies and found wide variability in variations of renal arteries among different population group.

### Conclusions:

With the increasing demand for kidney transplantation, living donor grafts have become the major source for maintaining the donor pool, and the successful allograft with multiple arteries has become a necessity. Knowledge of the variations in the renal arteries is important for urologists, radiologists and surgeons in general. It is of great importance in performing operations like segmental resections, partial nephrectomy, and renal transplantation

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