

# Study on Aberrant Renal Arteries in South Indian Population

Dr. Girish V. Patil<sup>1</sup>, Dr. Shishirkumar<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Anatomy, DM- Wayanad Institute of Medical Sciences, Meppadi, Wayanad. Kerala, India

<sup>2</sup>Assistant Professor, Department of Anatomy, DM- Wayanad Institute of Medical Sciences, Meppadi, Wayanad. Kerala, India

**Abstract:** Variations in the number of renal arteries and their positions with respect to the renal veins are common. The aberrant renal arteries are common in 30% of the individuals, usually arising from the aorta above or below the main renal artery and following it to the renal hilum. The aberrant renal arteries are more common on the left side than on the right one. Studies on cadavers have shown that there is more than one renal artery in 15% and 20% of the cases on the right and left sides respectively. The aberrant vessels are more common in the ectopic kidneys; the unilateral examples are three times more common than the bilateral and more often in female than in the males. Total 100 adult human kidneys were studied. The accessory renal artery was described for the first time, by Eustachius [1] in 1552, and later by Macalister [2] (1882) and Kater [3] (1901). The incidence of the same was first mentioned in 1892 by Thane [4]. The accessory or aberrant renal arteries have been of interest to the clinicians for many years, mainly because of the possible part that the vessel may play in the causation of the hydronephrosis.

**Keywords:** Aberrant renal arteries, Hilum, Hydronephrosis, Kidneys, Variations.

## 1. Introduction

Variations in the number of renal arteries and their positions with respect to the renal veins are common. Supernumerary arteries, usually two or three, are about twice as common in the kidney. During development, in the pelvis, the kidney receives its arterial supply from the aorta at continuously higher levels. The lower vessels usually degenerate, but the vascular variations such as the aberrant or accessory renal arteries may result from the persistence of those embryonic lateral splanchnic vessels.

The aberrant renal arteries are common in 30% of the individuals, usually arising from the aorta above or below the main renal artery and following it to the renal hilum. Higher or lower origins are not uncommon, as also accessory artery or leash of arteries passing to the superior or inferior pole. Rarely, the aberrant renal arteries arise from the celiac, superior mesenteric arteries, near the aortic bifurcation or from the common iliac arteries.

The aberrant renal arteries are more common on the left side than on the right one. Studies on cadavers have shown that there is more than one renal artery in 15% and 20% of the cases on the right and left sides respectively. Such vessels entering the lower pole are more frequent than those to the upper pole. The arteries to the lower pole usually arise from the aorta or common or internal iliac arteries or even from the superior mesenteric artery. And those to the upper pole arise either from the aorta or from the suprarenal artery. And the vessel on the right side tends to cross anterior to the inferior vena cava than posterior to it. The artery to the lower pole also called the polar vessel, crosses anterior to ureter at the ureteropelvic junction and may cause obstruction, thus resulting in hydronephrosis. Schools of thought are divided as to whether obstruction is infact due to kinking of the ureter by the vessel or whether it is due to a so far unexplained neuromuscular incoordination at the uretero pelvic junction. However, observations have shown

that the aberrant vessels accentuate a hydronephrosis present on account of another reason.

The aberrant vessels are more common in the ectopic kidneys; the unilateral examples are three times more common than the bilateral and more often in female than in the males. These vessels are infact, the segmental vessels with usual origin. The veins do not usually accompany them.

George Nelson Ronstrom [5] in 1938, in his study of 150 pairs of the kidneys, was probably the first to recognize the presence of the additional vessels at the hilum was due to the as early division of the renal artery, rather than a true multiplication or increase in the number of arteries. He did not however study the vessels within the kidney substance in conjunction with those of the pedicle, his conclusions being based on the study of the pedicle alone.

FT Graves in 1956 [6] pointed out that the aberrant renal arteries are not accessory vessels, as generally proposed, but are normal segmental arteries whose origin is more proximal or distal than the usual. This is an important observation, as the division of vessels of this kind will produce renal ischaemia, in the same way as it occurs when a segmental renal artery is tied. He ascribes the presence of such vessels to the persistence of the mesonephric arteries, which normally disappear.

## 2. Materials and Methods

Total 100 adult human kidneys were studied in the present works which were collected from the department of Anatomy DM- Wayanad Institute of Medical Sciences, Wayanad Kerala. The formalin preserved human kidneys were washed in running water to remove formalin. The capsule of each kidney was removed. The parenchymatous tissue was removed piece-meal with forceps under water, tracing the segmental arteries. The segmental branches were later painted with enamel oil paints using the following

colors. The dissected specimens were preserved in 7% formalin. Aberrant renal vessels replacing a particular segmental branch of main renal artery are identified and painted according to the colour of the particular segmental branch.

Vessel	Colour
Aorta, Renal artery and its anterior division	Red
Apical segmental artery	Yellow
Upper segmental artery	Blue
Middle segmental artery	Black
Lower segmental artery	Green
Posterior division and posterior segmental artery	White

### 3. Types of Accessory Renal Arteries are Described

#### a. 2 Types Of Single Accessory Renal Artery Are Described

- (i) THE SEGMENTAL TYPE, where a single accessory renal artery arises directly from the aorta and it replaces one or two of the segmental branches of the anterior division of the renal artery.
- (ii) THE DIVISIONAL TYPE, where the single accessory renal artery arises directly from the aorta and replaces the anterior or the posterior division of the renal artery.

b. THE DOUBLE ACCESSORY ARTERY consists of the renal branches from the aorta in addition to the renal artery and they replace one or two of the segmental branches, divisions or both usually given off from the renal artery.

### 4. Results



Figure 1: The segmental type of the single accessory renal artery



Figure 2: The divisional type of the single accessory renal artery



Figure 3: The double accessory renal artery

Table 1: Types of accessory renal arteries replacing segmental arteries

Specimen side	Superior accessory renal artery replacing the apical segmental artery.	Inferior accessory renal artery replacing the lower segmental artery.	Replaces the anterior or the posterior division of the renal artery.
Right	4%	8%	-
Left	-	12%	4%
Total	4%	20%	4%

#### A. Single type accessory renal artery.

1. Segmental type- The apical segmental artery arises directly from the aorta, just above the main renal artery in 4% of specimens and appears to be relatively more common among the accessory renal arterial patterns.
2. The lower segmental artery is seen in 20% of specimens. Here, the artery arises just below the main renal trunk and runs parallel to it and finally descend to supply its own segment.
3. In 4% of cases, anterior and posterior divisions were seen to take a direct origin from the aorta; at the hilum, the divisions branched to supply their respective renal segments.

### 5. Discussion

Table 2: The accessory renal arteries

Sl. No.	Authors	Year	Total no. of kidneys studied	Percentage
1	Thane [4]	1892	-	20%
2	Eisendrath [7]	1920	218	28.1%
3	Helstrom [8]	1927	-	50%
4	Anderson et al [9]	1936	400	47%
5	Graves [6]	1956	30	-
6	Kher et al [10]	1961	98	12.2%
7	Verma et al [11]	1963	50	6%
8	Present work	2005	50	28%

The accessory renal artery was described for the first time, by Eustachius [1] in 1552, and later by Macalister [2] (1882) and Kater [3] (1901). The incidence of the same was first mentioned in 1892 by Thane [4]. The accessory or aberrant renal arteries have been of interest to the clinicians for many years, mainly because of the possible part that the vessel may play in the causation of the hydronephrosis. Many cases have been described in literature in which, one aberrant or accessory artery is found to enter the lower pole of the kidney and to lie in such a position as to appear to obstruct the outflow of the urine at the pelvi-ureteric

junction. However, opinion is also divided on the advisability of dividing the aberrant vessel, as the effects of such an intervention upon the obstruction, and the possibility of resultant necrosis of part of the kidney have to be borne in mind. In surgical practice, the ligation of a vessel on the ground that it is an accessory artery, will lead to necrosis of a segment or part of a segment, if proper care is not taken.

The incidence of aberrant artery has been variously reported in nearly 50% of cases by Hellstrom [8] (1927) and in 25% by Edsman [12] (1954). In the present study, the same was detected in 28% of cases.

A number of others have reported that the aberrant artery to the lower segment is a frequent observation. Weinstein Countiss and Derbes [13] (1940), found that the incidence of accessory vessels passing from the aorta to the lower pole was approximately twice that of those directed towards the upper pole.

## 6. Conclusion

The concept of the aberrant renal arteries, is important, not only for the understanding of the arterial pattern in the study of anatomy but also for the practice of surgery, since the ligation of an aberrant artery will lead to necrosis of a segment or part of a segment.

The valuable contribution of anatomical knowledge to operative surgery, particularly in partial or segmental resection of kidneys, will help further development of different techniques for the removal of calculi or affected part of kidneys.

## References

- [1] Eustachius B. "The aberrant renal arteries". *J of Anat*, 1952; 98:733-738.
- [2] Macalister. "Partial nephrectomy in the treatment of renal calculi". *Ann Roy Coll Surg (Eng)*, 1882; 11:32-46.
- [3] Kater "The aberrant artery, its division or conservation in hydronephrosis". *Br J of Urol*, 1901; 23:6-22.
- [4] Thane "The arterial supply of human kidney, with special reference to accessory renal arteries". *Br J Surg*, 1892; 50:368-374.
- [5] George Nelson Ronstrom. "Vascular supply of the human kidney based upon dissection and study of corrosion preparation". *J of Anat*, 1938; 23:453-456.
- [6] Graves F T. "The aberrant renal artery". *J of Anat* 1956; 90:553-558.
- [7] Eisendrath D N, Rolnick H C. "Conservative renal surgery an anatomical basis". *Br J Surg* 1942; 48:1-8.
- [8] Helstrom. "The aberrant renal artery". *J of Anat*, 1927; 91:289-330.
- [9] Anderson J C, "Hydronephrosis hydrocalysis modern trends in urology". *E. S. P* 1953; 23:96-110.
- [10] Kher et al. "The arteries of human kidney". *J of Anat* 1966; 87:58-63.
- [11] Verma et al. "Anatomy of renal vascular segments". *J of Anat soc of India* 1961; 10:12-14.

[12] Edsman. "Accessory vessels of the kidney and their diagnosis in hydronephrosis". *Radiol Stocks*, 1954; 42:26-32.

[13] Countiss and Derbes. "The correlation between renal vascularisation and lobulation of the kidney". *Br J Urol*, 1940; 36:549-555.

## Author Profile



**Dr. Girish V Patil** has completed his MBBS from KIMS Hubli and has completed his M.D in Anatomy from VIMS Bellary. He has also finished his DNB Anatomy. He is presently working as an Associate

Professor in the Department Of Anatomy, DM-WIMS Meppadi, Kerala, India



**Dr. Shishirkumar** has completed his MBBS from KLE'S JNMC Belgaum and has completed his M.D in Anatomy from K.S.Hegde Medical Academy, Deralakatte, Mangalore. He is presently working as an Assistant Professor in the Department Of Anatomy,

DM-WIMS Meppadi, Kerala, India