

## A Bilateral Multiple Renal Artery with Lobulated Left Kidney – A Case Report

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**Abstracts: Introduction:** A precise knowledge of variation of the renal artery is essential for a variety of surgical and radiological procedures. **Method:** One such variation observed during routine educational dissection of a 65-year-old male cadaver at SMIMER, Surat. The cadaver was preserved using standard embalming technique and dissection carried out based on the method given in "CUNNINGHAM'S MANUAL OF PRACTICAL ANATOMY" Volume-II. **Observation:** (i) On right side an additional renal artery originated from the right side of abdominal aorta above the normal renal artery which soon divides into two branches which run parallel towards the renal hilum. The normal renal artery arches forward and downward in front of right renal vein and divides into two segmental arteries. The upper branch of additional artery give supra renal branch and continue as upper segmental artery while the lower branch divide into two segmental arteries. (ii) On left side one small additional renal artery originated from the left side of abdominal aorta above the normal renal artery and pass horizontally above left renal vein towards renal hilum. The normal artery arches behind left renal vein and divide into two segmental arteries. Another additional artery originated from left side of abdominal aorta just below the origin of inferior mesenteric artery run upward and laterally and divide into two segmental arteries one of which supply the accessory lobule of left kidney and another branch supply lower pole of left kidney. **Conclusion:** The comprehensive knowledge of variations of renal artery is the key issue in determining the technical feasibility of different surgical interventions of kidney.

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**Key Words:** Additional renal artery, Variation of renal artery, Lobulated kidney

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**Introduction:** The paired renal arteries, taking 20% of the cardiac output arise from lateral aspect of the aorta just below the origin of the superior mesenteric artery.<sup>1</sup> The right renal artery is longer, often higher than left and passing posterior to right renal vein, inferior vena cava.<sup>1</sup> The left renal artery is a little lower and passes behind the left renal vein and more anteriorly the body of the pancreas and splenic vein.<sup>1</sup>

In 70% of individual a single renal artery divides into anterior and posterior divisions near the renal hilum and these divide into 4-5 segmental arteries supplying the renal vascular segments. In majority of the cases five arterial segments namely apical, superior, middle, inferior & posterior are identified, although there can be considerable variations from this pattern.<sup>1</sup> Moreover, different vascular segments of the kidney are supplied by end arteries but larger intra-renal veins have no segmental organization and anastomose freely.<sup>1</sup> Most of the variation of renal vessels remains unrecognized until being noticed during any surgical procedure, autopsy or arteriography. So, a rare case where the right kidney supplied by two

renal arteries and the left kidney supplied by three arteries is reported here.

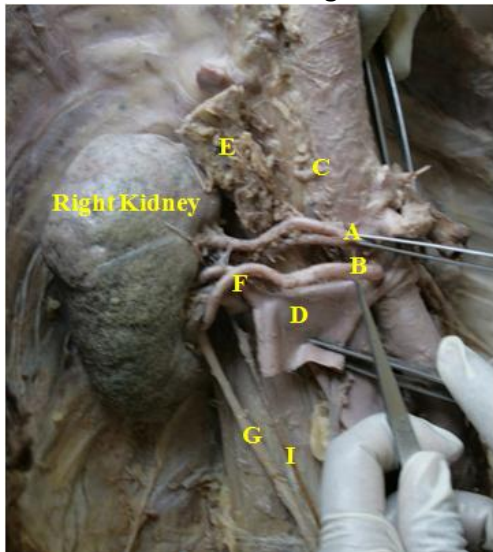
**Material and Methods:** Different renal arterial abnormalities of both sides encountered during routine educational dissection of a 65-year-old male cadaver at SMIMER, Surat in the year May'2014. The cadaver was preserved using standard embalming technique and dissection carried out based on the method given in "CUNNINGHAM'S MANUAL OF PRACTICAL ANATOMY" Volume-II.

The stomach, intestine and part of peritoneum were removed to get clear access to posterior abdominal wall structures like kidneys, associated blood vessels and nerves. These structures were dissected out carefully by following proper steps and photographs were taken.

**Result:** (i) On right side: The right renal artery originated from the right side of abdominal aorta, passes horizontally first in front of right crus of diaphragm behind inferior vena cava then arch forward and downward in front of right renal vein

and divide into two segmental arteries. The additional renal artery originated from the right side of abdominal aorta above the normal renal artery soon divide into two branches which run parallel towards renal hilum. The upper branch of additional artery give supra renal branch and continue as upper segmental artery while the lower branch divide into two segmental arteries.

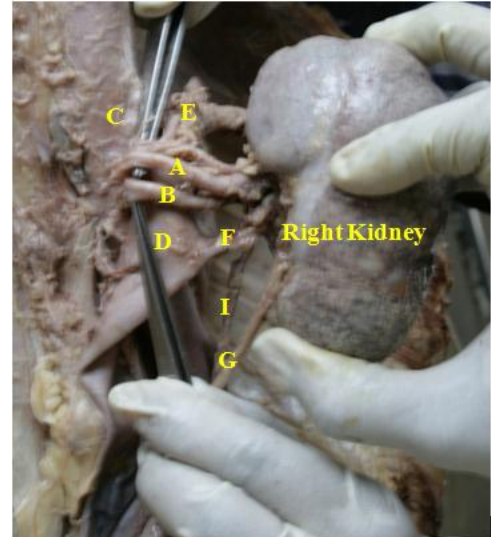
**Figure 1: Photograph Of Right Kidney From The Front Showing**



- A= Additional Renal Artery Dividing Into Two Branches.
- B= Normal Renal Artery Dividing Into Two Segmental Arteries.
- C= Abdominal Aorta.
- D= Inferior Vena Cava (Retracted Downward).
- E= Right Supra Renal Gland with Its Artery.
- F= Right Renal Vein.
- G= Right ureter.
- I = Right testicular vein.

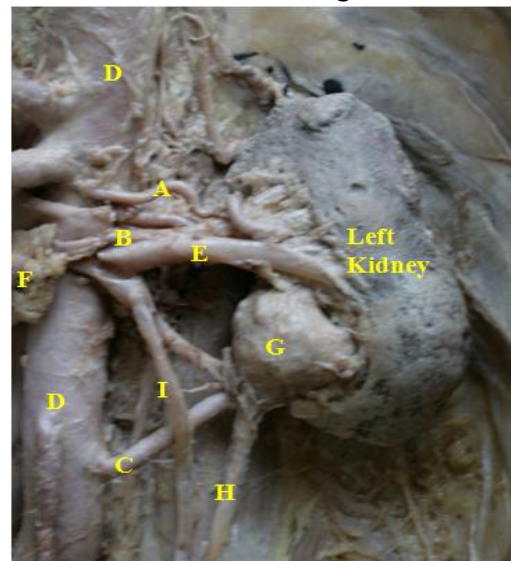
(ii) On left side: The left renal artery originated from left side of abdominal aorta, passes horizontally first in front of left crus of diaphragm and behind left renal vein and divide into two segmental arteries. One small additional renal artery originated from the left side of abdominal aorta above the normal renal artery provide left suprarenal branch and passes horizontally above the left renal vein towards renal hilum as segmental artery. Another additional artery originated from left side of abdominal aorta just below the origin of inferior mesenteric artery run upward and laterally and divide into two segmental arteries one of which supply the accessory lobule of left kidney and another branch supply lower pole of left kidney.

**Figure2: Photograph Of Right Kidney (Retracted To The Left) Showing**



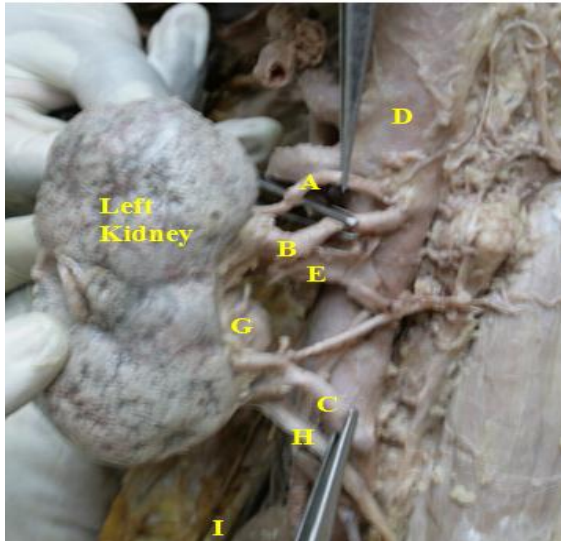
- A= Additional renal artery dividing into two branches.
- B= Normal renal artery.
- C= Abdominal aorta.
- D= Inferior vena cava.
- E= Right supra renal gland with its artery.
- F= Right renal vein.
- G= Right ureter.
- I = Right testicular vein.

**Figure 3: Photograph of Left Kidney from the Front Showing**



- A= Upper additional renal artery.
- B= Normal renal artery dividing into two segmental arteries.
- C= Lower additional renal artery dividing into lower segmental artery and accessory lobular artery.
- D= Abdominal aorta.
- E= Left renal vein.
- F= Left supra renal gland (retracted to right).
- G= Accessory lobule of left kidney.
- H= Left ureter.
- I = Left testicular vein.

**Figure 4: Photograph Left Kidney (Retracted To the Right) Showing**



- A= Upper additional renal artery.  
 B= Normal renal artery dividing into two segmental arteries.  
 C= Lower additional renal artery dividing into lower segmental artery and accessory lobular artery.  
 D= Abdominal aorta.  
 E= Left renal vein.  
 G= Accessory lobule of left kidney.  
 H= Left ureter.  
 I= Left testicular vein.

So, here right kidney is supplied by two arteries while left kidney is supplied by three arteries. The relation at the hilum from above downwards on right side is: Upper and lower branch of additional artery, right renal artery, right renal vein and pelvis of ureter. On left side from above downwards they are: Left renal artery smaller upper additional artery, left renal vein, accessory lobule of kidney with its artery, additional lower renal artery and pelvis of ureter.

**Discussion:** It is widely accepted that renal vessels, specially the renal arteries exhibit a high degree of variations and the knowledge of accessory renal arteries and their variable origins have profound clinical significance in renal surgery.<sup>1</sup>

Accessory renal arteries are found in 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.<sup>1</sup> In this case it is above the main renal artery.

Loukas et al (2005) reported an accessory renal artery originating from a common trunk with inferior mesenteric artery.<sup>2</sup> Rarely additional renal arteries may arise from the coeliac trunk, superior mesenteric artery, near the aortic bifurcation or from the common iliac arteries.<sup>3</sup> Accessory renal vessels to inferior pole of kidney cross anterior to the ureter and may cause hydronephrosis by obstructing the ureter.<sup>3</sup> Kaneko et al (2008) reported the cases of additional renal artery emerging from the lateral aspect of the aorta, below the level of inferior mesenteric artery in 2.4% of cadavers on the right side and 1.8% on the left.<sup>4</sup> An angiographic evaluation of 855 cases by Ozkan et al (2006) demonstrated several variations of renal artery namely multiple arteries in 24%, bilateral multiple arteries in 5% and early division in 8% of the cases.<sup>5</sup> Moreover, additional renal arteries were found in 16% of the cases on the right side and in 13% of the cases on the left side.<sup>5</sup> In the year 2013, Satyapal et al analyzed 1244 pairs of kidneys and reported additional renal arteries on the right side in 18.6% and on the left side in 27.6% of the cases.<sup>6</sup> Thereafter in the year 2005, dissection of 40 cadavers was carried out and examine by Dhar et al. Finally, the study revealed a single main renal artery on either side in 80% of the specimens and multiple renal arteries in 20% of the specimens where the unilateral cases (15%) were more commonly encountered than the bilateral cases.<sup>7</sup> A case bilateral triple renal arteries was also reported by Pestemalci et al in the year 2009.<sup>8</sup> Similarly, many cases of bilateral double renal arteries and unilateral multiple renal arteries originating from lateral side of abdominal aorta were also reported in subsequent years.<sup>9-12</sup> Tanyeli et al (2006) reported an interesting case of double renal artery where the superior renal artery crossed inferior renal artery as they passed towards kidney.

**Conclusion:** The precise knowledge regarding variation of renal artery is gaining importance with increasing number of renal transplants, vascular reconstruction and various other renal surgical and radiological techniques being performed nowadays.<sup>4</sup> It also facilitates a safe approach in the management of renal trauma and tumor cases.<sup>4</sup> An undiagnosed variation of renal artery may pose great difficulty during surgery.<sup>5,6</sup> In selected cases

an arteriography or CT angiography is helpful in reducing unexpected problems during surgery and improving the outcome.<sup>5</sup> Thus the renal arterial pattern remains the key issue in determining the feasibility of surgical interventions as well as the post-operative management.<sup>6</sup> The possibility of additional renal artery always be kept in mind prior to renal surgeries.<sup>5,13</sup> The additional artery may compress the normal artery compromising renal blood flow. Further the additional artery to the lower pole may compress the proximal ureter producing hydronephrosis.<sup>3</sup>

So, our findings of the present case will add to the long list of diversity of variations among the renal arteries which is essential for surgeons and radiologists and encourage all anatomists to detect other possible variations in future.

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