

Bilateral Multiple Renal Vessels: A Case Report

SULABHA HANUMANT DESHPANDE¹, BALAPPA MUREGAPPA BANNUR², BABASAHEB GURUSIDDAPPAGOU PATIL³

ABSTRACT

The kidneys receive arterial supply from the paired renal arteries. During routine dissection we observed in an adult male cadaver the following variation. Bilateral variation is seen in 5%-10% of individuals. The right kidney was receiving 3 renal arteries. Two were arising from the abdominal aorta just below the origin of superior mesenteric artery and the 3rd artery was arising from aorta, below the origin of Inferior Mesenteric artery. The left kidney received 2 renal arteries, both arising from aorta at a lower level than right, just below the origin of superior mesenteric artery. On the right side, 2 renal veins were independently draining into inferior vena cava. It is important to be able to depict all accessory renal arteries, because accessory renal arteries are end arteries. The main clinical significance of arteries entering the lower pole is that they may obstruct the ureter and lead to hydronephrosis. It is important to consider these results while using non-angiographic, non-invasive methods for investigating renal artery stenosis, as well as, during surgeries related to renal arteries.

Keywords: Renal arteries, Renal transplant, Retroperitoneal region

CASE REPORT

During routine dissection in the department of anatomy, BLDEU's Shri B.M. Patil Medical College, Bijapur, India, we observed in an adult male cadaver (age unknown) the following variation:-

The right kidney was receiving 3 renal arteries. Two were arising from the abdominal aorta just below the origin of superior mesenteric artery [Table/Fig-1]. Both passed from posterior to inferior vena cava and reached the hilum. Before entering the hilum both divided into anterior and posterior divisions. The upper artery gave a twig which gave a branch to upper pole of the kidney which in turn gave a lower suprarenal artery. The 3rd artery was arising from aorta, below the origin of Inferior Mesenteric artery. It passed in front of inferior vena cava and reached the hilum. This is termed as precaval renal artery. At the hilum it was seen posterior to pelvis of the kidney.

The left kidney received 2 renal arteries, both arising from aorta at a lower level than right just below the origin of superior mesenteric artery [Table/Fig-1]. Both were superficially crossed by Left suprarenal vein. The upper one gave a twig which gave a branch to upper pole of the kidney and lower supra renal artery. Before reaching the hilum, both divided into anterior and posterior divisions. The lower

one gave another branch which entered the hilum of the kidney. On the right side 2 renal veins [Table/Fig-2] were independently draining into inferior vena cava.

DISCUSSION

Renal arterial variations are more common than renal veins. The kidneys receive arterial supply from the paired renal arteries. They carry about 20% of the cardiac output to supply the kidneys, which represent less than 1/100th of the total body weight. The arteries the branch laterally from the aorta just below the origin of the superior mesenteric artery. In 70% of individuals, a single renal artery is present, in the remaining 30%, accessory renal arteries are seen. They arise from the abdominal aorta above or below the main renal artery and follow it to the hilum [1].

Kadir et al., reported that Accessory renal arteries constitute the most common, clinically important renal vascular variant. Multiple renal arteries are unilateral in 30% of the patients and bilateral in approximately 10%. In rare cases, they can arise from the lower thoracic aorta or from lumbar or mesenteric arteries. Usually, the accessory artery courses into the renal hilum to perfuse the upper or lower renal poles. Accessory vessels to the polar regions are usually smaller than accessory hilar renal arteries, which are typically equal in size to a single renal artery [2]. Kadir et al., stated that in his



[Table/Fig-1]: Both kidneys and supra renal glands with bilateral multiple renal arteries and inferior vena cava reflected over the right kidney
1. upper right renal artery, 2. upper right supra renal artery, 3. middle right renal artery, 4. lower right renal artery, 5. upper left renal artery, 6. lower left renal artery, 7. inferior mesenteric artery, 8. Abdominal aorta



[Table/Fig-2]: Both kidneys and supra renal glands
1. upper right renal vein, 2. lower right renal vein

patients, the frequency rate of early division and bilateral ERA was 8% and 5%, respectively, which is low when compared to other major series [3].

The Satyapal et al., study aimed at establishing the incidence of additional renal arteries. Two subsets were analysed. Clinical series-130 renal angiograms performed on renal transplant donors and 32 cadaver kidneys were evaluated. Incidence of first and second additional arteries were respectively, 23.2% (R: 18.6%; L: 27.6%) and 4.5% (R: 4.7%; L: 4.4%). Additional arteries occurred more frequently on the left (L: 32.0%; R: 23.3%). The incidence bilaterally was 10.2% [4].

Dhar and Lal studied 40 kidneys. They revealed a single main renal artery on either side in 80% of the specimens. Multiple (accessory) renal arteries were observed in 20% of the specimens with unilateral anomaly (15%) being more commonly encountered than bilateral anomaly (5%) [5].

Özkan et al., in their angiographic evaluation study found that there was only one renal artery feeding both of the kidneys in 76% of the patients. More than one renal artery was found in 202 (24%) patients. More than one renal artery was observed on the right side in 135 (16%) patients and on the left side in 113 (13%) patients. In 46 (5%) patients, there was more than one renal artery on both sides. Of all the observed ERA, 16% were on the right and 13% were on the left [6].

Hlaing et al reported accessory renal artery in 4% out of the 50 cadaveric kidneys studied. Left accessory renal artery of one kidney, at the lower pole divided into anterior and posterior branches. The second variant was seen in right kidney, which showed presence of single accessory renal artery at the upper pole and double accessory renal artery at the lower pole. This is a rare entity [7].

Babu and Gupta reports an incidental finding of multiple renal arteries, three on the right side and four on the left side in a male patient who was evaluated for a suspected mass in the right lobe of liver. On the right side, they observed the presence of two precaval additional renal arteries of aortic origin and on the left side an additional renal artery entering the lower pole from left common iliac artery [8].

Embryological significance

The primitive kidney is a segmental organ and its primitive vessels are probably segmental, i. e., one artery for each segment, so that the persistence of the embryonic condition would mean that each kidney, instead of being supplied by a single renal artery, might receive from two to five renal arteries. Accessory renal arteries are regarded as the persistent embryonic lateral splanchnic arteries.

During changes in kidney position, they receive their blood supply from the vessels that are close to them. Initially they are branches from the common iliac artery. Later from the distal end of aorta.

When they are located at a higher level, new branches arise from aorta. Normally, the caudal branches of renal arteries undergo involution and disappear. The position of kidneys becomes fixed once they come into contact with the suprarenal glands in 9th week of intrauterine life. The kidneys receive the most cranial branches from the abdominal aorta. These branches become the permanent renal arteries. The right renal artery is longer and often more superior [9].

Fernandes et al., reported that three renal veins draining the right kidney. They were three calibrous veins having independent courses up to the inferior vena cava [10].

Hazirolan et al., reported the most common venous variant is the presence of supernumerary renal veins which can be seen in approximately 15–30% of the individuals and occasionally the accessory renal vein that can drain into the iliac vein [11].

In the present case, it was observed that 3 renal arteries on right and 2 on left side. The lower right is termed as pre caval right renal artery. An additional renal vein on right side was observed which drained independently into inferior vena cava.

CONCLUSION

The anatomical knowledge of the renal arteries and the renal veins and its variations are of extreme importance for the surgeon who approaches the retroperitoneal region during the renal transplant surgeries. When placement of an inferior vena cava filter is considered it may increase surgical morbidity during operations.

REFERENCES

- [1] Standing S. Gray's Anatomy: The Anatomical Basis of the Clinical Practice, 39th edition. Edinburgh: Elsevier Churchill Livingstone. 2008; 1231.
- [2] Kadir S. Angiography of the kidneys. In: Kadir S (ed.), *Diagnostic angiography*. Philadelphia, Pa: Saunders. 1986; 445–95.
- [3] Kadir S. Kidneys. In: Kadir S (ed.), *Atlas of normal and variant angiographic anatomy*. Philadelphia: W.B. Saunders Company, 1991; 387–429.
- [4] Satyapal KS, Haffjee AA, Singh B, Ramsarop L, Robbs JV, Kalideen JM. Additional renal arteries: incidence and morphometry. *Surg Radiol Anat*. 2001; 23(1): 33–8.
- [5] Dhar P, Lal K. Main and accessory renal arteries—A morphological study. *Ital J Anat Embryol*. 2005; 11: 101–10.
- [6] Özkan U, Oguzkurt L, Tercan F, Kizilkilç O, Koç Z, Koca N. Renal artery origins and variations: angiographic evaluation of 855 consecutive patients. *Diagn Interv Radiol*. 2006; 12:183–6.
- [7] Hlaing KPP, Das S, Sulaiman IM, Latiff AA, Ghafar NA, Suhaimi F et al. Accessory Renal vessels at the upper and lower pole of the kidney: A cadaveric case study with clinical implications. *Bratisl Lek Listy*. 2010; 111: 308–10.
- [9] Babu CSR, Gupta OP. MDCT angiographic evaluation of multiple renal arteries: a case report. *IJAV*. 2012; 5: 137–40.
- [9] Moore KL, Persaud TVN. The Urogenital System. In: *The Developing Human*. 8th (ed.). Philadelphia. Elsevier. 2008; 249–51.
- [10] Fernandes RMP, Conte FHP, Favorito LA, Abidu-Figueiredo M, Babinsk MA. Triple right renal vein: an uncommon variation. *Int J Morphol*. 2005; 23: 231–3.
- [11] Hazirolan T, Öz M, Türkbey B, Karaosmanoglu AD, Oguz BS, Canyigi M. CT angiography of the renal arteries and veins: normal anatomy and variants. *Diagn Interv Radiol*. 2011; 17:67–73.

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Anatomy, BLDEU's Shri B.M.Patil Medical College, Bijapur-03, India.
2. Professor and HOD, Department of Anatomy, BLDEU's Shri B.M.Patil Medical College, Bijapur-03, India.
3. Professor, Department of Anatomy, BLDEU's Shri B.M.Patil Medical College, Bijapur-03, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sulabha Hanumant Deshpande,
Assistant Professor, Department of Anatomy, BLDEU's Shri B.M.Patil Medical College, Bijapur-03, India.
Phone: 09901665290, E-mail: drsulabhahd@gmail.com

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