



# Ectopic vascularization of the right kidney arising from contralateral common iliac artery

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## Abstract

**Background** Variant renal arteries have been reported in 20~30% of the entire population. The anatomic variations among advanced patients should be investigated when performing surgery or interventional procedures on the kidney.

Most variant renal arteries originated from various level of the abdominal aorta. Very rarely, this case shows renal artery originated from the contralateral common iliac artery with other accessory arteries.

**Case presentation** MDCT angiography revealed several anatomical variants of the right kidney. There were four right renal arteries. The main renal artery originated from the left proximal common iliac artery and other renal artery originated from the aortic bifurcation. The other two renal arteries arose from the abdominal aorta, lower thoracic T12 level and lower lumbar L4 level. The right kidney was located at the level of the third to fifth lumbar vertebra. And renal pelvis of the right kidney was laterally rotated.

**Conclusion** This case documented a rare anatomic variant, involving multiple accessory renal arteries, including the main artery originating from the contralateral iliac artery, caused by a specific renal embryological condition. These variants should be analysed to effectively perform surgical and interventional procedures.

**Keywords** Variant renal artery · Accessory renal artery · Embryological variation of renal artery · Ectopic kidney

## Introduction

Renal arteries mostly arise from the abdominal aorta at the level of the L1–L2 vertebral body or intervertebral disc. However, variant renal arteries have been reported in 30% of the entire population [1, 2].

The incidence rate of variant renal artery reflects the mechanism by which the renal blood supply changes during the embryonic stage and early fetal life. As the kidneys migrate cranially from the pelvis, they receive new branches from the superior aspect of the aorta. The preceding caudal vessels usually regress and disappear, but failure to regress leads to variant renal arteries [3]. It is important to recognize the anatomic variation in advanced when performing surgery or interventional procedures on the kidney.

We report a rare case of anatomical variants in renal arteries with an ectopic kidney, incidentally detected on multi-detector computed tomographic (MDCT) angiography for pre-operative evaluation of a skin defect in the left leg.

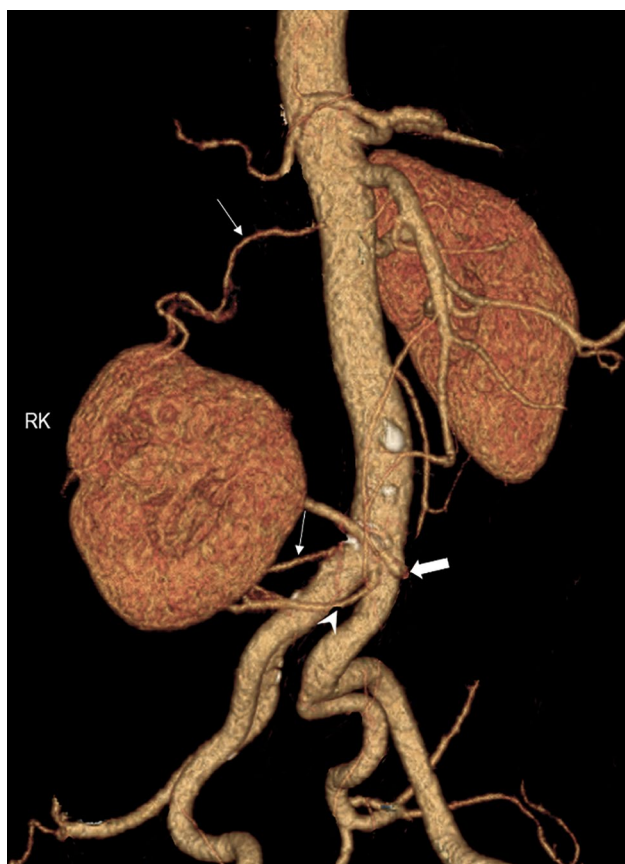
These anatomic variations include the main renal artery originated from a contralateral common iliac artery (CIA) and the other accessory arteries arose from the abdominal aorta, level T12/L1 and L4. The accessory renal arteries arising from the contralateral CIA are very rare. It was reported only several cases by Halloul et al., Hounton et al., and Erdogan et al. [4–6].

## Case Presentation

A 60-year-old male with unremarkable medical history was transferred to the Department of Plastic Surgery for the management of a posttraumatic wound in the left lower leg. He was involved in a traffic accident about 45 years ago. The patient was consulted for skin ulceration management and pain control.

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**Fig. 1** The main renal artery (thick arrow) originates from the left proximal CIA, another renal artery (arrowhead) originates from the aortic bifurcation and the other two renal arteries (arrow) branch from the abdominal aorta, lower thoracic level T12 and lower lumbar level L4. *RK* Right kidney

During the preoperative evaluation, MDCT angiography revealed several anatomical variants of the right kidney. There were four right renal arteries. The main renal artery originated from the left proximal CIA and supplied the middle pole of the right kidney. The other renal artery originated from the aortic bifurcation and supplied the lower pole of the right kidney. The other two renal arteries, branching from the abdominal aorta, lower thoracic level T12, and lower lumbar level L4, supplied the upper pole of the right kidney (Fig. 1).

The normal size of the adult kidney is about 10–14 cm long in size and is shaped like a bean. In addition, the renal hilum lies vertically at the anteromedial aspect of the kidney. However, the size of this kidney was 8 cm long in size, small and spherical in shape. The renal hilum faces anteriorly due to incomplete rotation. The ureter was located laterally above the normal position without functional abnormality.

He underwent elective surgery for debridement and a split-thickness skin grafting for the skin defects of the left leg. He was discharged on postoperative day 1. The pain and skin defects improved without complications.

## Discussion

Vascular variants of renal arteries have been commonly reported. Although the incidence varies geographically, it has reportedly reached up to 30%. The main right renal artery typically originates from the abdominal aorta between the upper margin of L1 and the lower margin of the L2 vertebra, below the superior mesenteric artery [7].

The development of the kidney and its vessels is complex, and the development of kidney arterioles remains poorly understood. Renal artery variants are vestigial structures caused by failure to degenerate during the ascent of metanephros. Embryologically in the 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 [3]. Felix divides these nine pairs of arteries into three groups: cranial (1st and 2nd pair), middle (3<sup>rd</sup>–5th pair), and caudal (6<sup>th</sup>–9th pair) [7]. The renal arteries develop from a single pair in the middle group. The remaining arteries of the middle group give rise to accessory or aberrant renal arteries [6].

The abnormalities in the renal arteries are related to the various developmental positions of the kidneys. During early development, the kidneys locate in the sacral region of the embryo. As the disproportionate growth of the body, the final position of the kidneys is in the lumbar region. As the location of the kidneys changes, their arterial supply also shifts from the common iliac artery to the abdominal aorta. The kidneys receive vascular supply from branches of the dorsal aorta called renal arteries [3, 8, 9].

Accessory renal arteries are also very common which mostly originate from the abdominal aorta. In some reports, the accessory arteries originated from the CIA, superior mesenteric arteries or inferior mesenteric arteries [3–5, 10].

In rare cases, such as the present case, the main renal artery originated from the contralateral CIA. In most of these cases, the kidneys were located in the pelvis. In the present case, the kidney was located at the level of L2–L5, and the accessory renal artery originated from the aortic bifurcation, supplying the lower pole of the kidney.

It is clinically important to understand the anatomic variation of the renal arteries for the management of the following processes; kidney transplant surgery, abdominal aortic aneurysm treatment, abnormal renal artery treatment, renal vascular hypertension evaluation, and radiological interventions.

## Conclusion

This case documented a rare anatomic variant, involving multiple accessory renal arteries, including the main renal artery originating from the contralateral iliac artery, caused by specific renal embryological conditions. These variants should be analyzed to effectively perform surgical and interventional procedures.

**Authors' contributions** JKK: data collection, data analysis, manuscript writing, J-ML: data analysis, manuscript writing and editing, illustration, JUH: manuscript editing, SGC: manuscript editing.

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## Declarations

**Conflict of interest** There are no conflicts of interest to declare.

**Ethical approval** This manuscript has not been published or presented elsewhere in part or in entirety and is not under consideration by another journal. The study design was approved by the appropriate local ethics review board of University Inha. We have read and understood your journal's policies, and we believe that neither the manuscript nor the study violates any of these.

**Informed consent** Informed consent was obtained from participants included in the study. And the participant has consented to the submission of the case report to the journal.

## References

1. Beregi JP, Mauroy B, Willoteaux S, Mounier-Vehier C, Rémy-Jardin M, Francke J (1999) Anatomic variation in the origin of the main renal arteries: spiral CTA evaluation. *Eur Radiol* 9(7):1330–1334. <https://doi.org/10.1007/s003300050843>
2. Krishnaveni C, Kulkarni R (2013) A right ectopic kidney with bilateral multiple anomalies of the renal vasculature—a case report. *J Clin Diagn Res* 7(1):150–153
3. Al Dandan O, Hassan A, Almutairi A, Alakloby E, Fadaak K (2019) Malrotated right supernumerary kidney: case report of a rare anomaly. *Urol Case Rep* 26:100966–100966. <https://doi.org/10.1016/j.eucr.2019.100966>
4. Erdoğan H (2020) Evaluating the origin of vascular structures in ectopic kidneys with multidetector computed tomography. *Abdom Radiol* 45(6):1907–1914. <https://doi.org/10.1007/s00261-020-02455-0>
5. Halloul Z, Meyer F, Buerger T (2001) Ectopic vascularization of the right kidney by a contralateral origin of the main renal artery from the left common iliac artery: report of a case. *Surg Today* 31(4):371–373. <https://doi.org/10.1007/s005950170164>
6. Hunter J (1794) Vasculature of the body. *Br J Surg* 38:1–8
7. Gulas E, Wysiadecki G, Szymański J, Majos A, Stefańczyk L, Topol M, Polgaj M (2018) Morphological and clinical aspects of the occurrence of accessory (multiple) renal arteries. *Arch Med Sci* 14(2):442–453. <https://doi.org/10.5114/aoms.2015.55203>
8. Dhar P, Lal K (2005) Main and accessory renal arteries—a morphological study. *Ital J Anat Embryol* 110(2):101–110
9. Felix W (1912) Mesonephric arteries (aa. Mesonepharicae). In: Keibel LF, Mall FP (eds) *Manual of human embryology*. Lippincott, Philadelphia, pp 820–825
10. Hollinshead WH (1971) *Anatomy for surgeons*, 2nd edn. Harper & Row, New York

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