Case Report

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Unveiling the renal artery variation during anatomy dissection: a case report

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Abstract

Renal arteries typically arise from the abdominal aorta at the level of L1–L2 and supply the kidneys through a single hilar entry. However, multiple variations exist, including accessory, supernumerary, and polar arteries. Such variations are not rare and carry important implications for renal transplantation, vascular surgery, urology, and interventional radiology. We report and discuss a case of double accessory right renal artery identified during cadaveric dissection, highlighting embryological origins, clinical significance, and correlations with existing literature.

Keywords: double accessory renal artery; renal artery variation; right inferior polar artery

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Introduction

The kidneys are retroperitoneal organs which were typically supplied by a single renal artery branching from the lateral branch of the abdominal aorta between the L1 and L2 levels of vertebrae.[1] The renal artery is a paired branch that typically divides into anterior and posterior branches near the hilum.[2] However, the classical description of the renovascular is formed by a single renal artery and then occurs in less than 25% of the population, and encounters variation in the number of renal arteries and origin of their branches.[3] The knowledge of variation is also very important for surgical planning and laparoscopic procedures, which can lead to complications if not identified properly.[4] Understanding the variation in the renal artery is crucial as it also improves the surgical outcome and renal transplantation.[5]

The renal vessels have been variably termed as "accessory", "aberrant", or "supernumerary", but they are functionally end arteries supplying the distinct renal segments without any significant anastomosis.[6] Some other literature also classified the renal artery as hilar, superior polar, and inferior polar types.[7] The clinical significance of the variant is mainly in renal transplantation, where the multiple arteries require extra anastomosis or reconstruction, causing an increased risk of ischemia and thrombosis. The inferior polar arteries can also compress the ureter, leading to ureteropelvic junction obstruction.[3,8] Some of the studies also suggested that variation in the renal artery may also lead to renal vascular hypertension.[9,10]

Therefore, the identification of variants is essential in surgical and interventional radiological procedures, as the renal variations are higher in the affected kidney, where the accessory renal artery can also predict the high-grade of renal cell carcinoma.[11,12] Therefore, in this study, we present a cadaveric case with accessory renal arteries variation.

Case Report

We report a case of double accessory right renal arteries, which was identified during the routine cadaveric dissection at the Department of Anatomy, National Medical College and teaching hospital, Birgunj, Nepal. A 40 years old male cadaver displayed the rare variation showing an accessory renal artery that originated separately from the abdominal aorta (**Figure 1**). The artery was found to be inferior to the renal artery, which was rising and entering the inferior pole of the right kidney. This

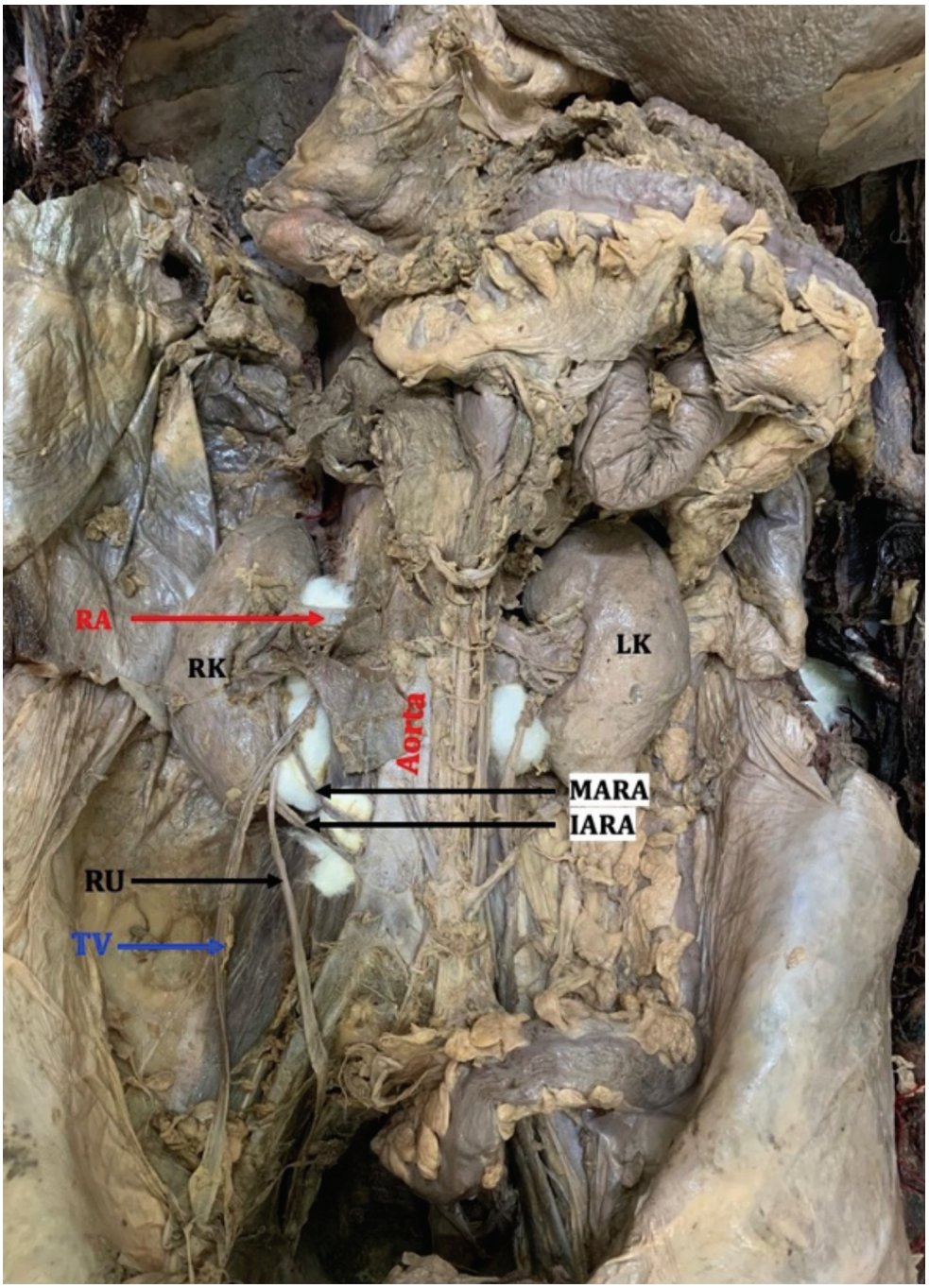


Figure 1. Accessory renal arteries on right kidney. **IARA:** inferior accessory renal artery; **LK:** left kidney; **MARA:** middle accessory renal artery; **RA:** renal artery; **RK:** right kidney; **RU:** right ureter; **TV:** testicular vein.

corresponds to the right inferior polar artery as described by the Sampaio-Passos classification.[13] Similarly, another middle accessory hilar artery arises from the abdominal aorta and enters the hilum as the right accessory hilar artery. When the right and left renal arteries were observed, both arose from the abdominal aorta and entered the corresponding hilum normally (**Figure 2**).

Discussion

The variety of variations in the renal artery has been well documented. However, the double accessory right renal artery identified during a routine dissection procedure was very rarely identified as the inferior polar artery and middle accessory hilar artery. A cadaveric examination of renal artery variation demonstrated that 52% of kidneys displayed multiple renal arteries, indicating a significant-

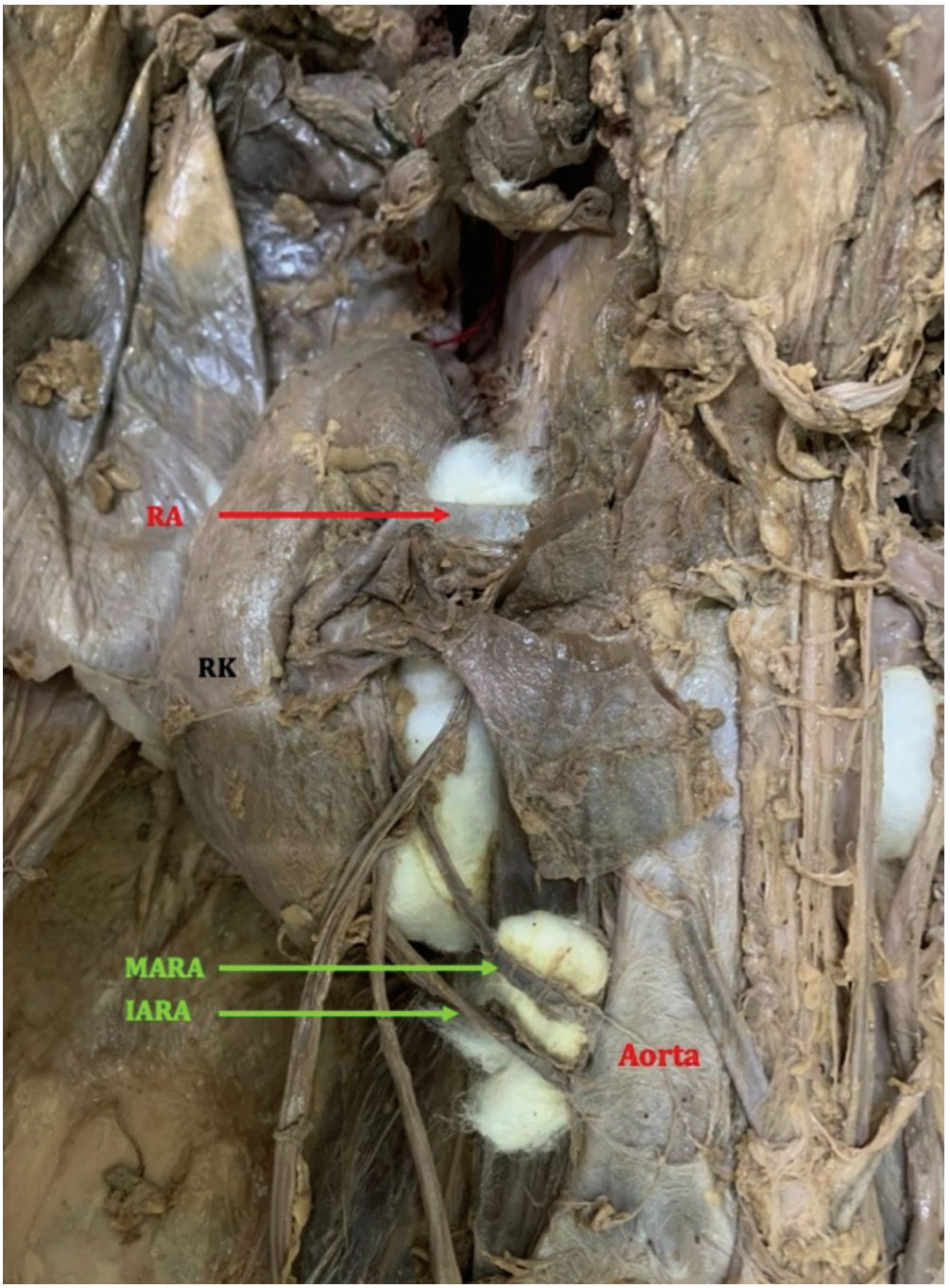


Figure 2. Right kidney showing variable relations of accessory renal artery. **IARA:** inferior accessory renal artery; **MARA:** middle accessory renal artery; **RA:** renal artery; **RK:** right kidney.

ly high incidence of variation, with 1.91% of cases displaying two accessory renal arteries on the right side, more prevalent in males at 3.08%.[14,15] This was also supported by the study of Lama and Pradhan,[6] 20% and Ozkan et al.,[16] 25% respectively.

The renal artery develops from the ninth pair of lateral mesonephric arteries, branching from the dorsal aorta. During the renal ascent, the successive vessels degenerate and are replaced by higher-level arteries. The persistence of more than one artery, particularly in the middle group, results in the multiple or polar artery.[17,18] Such a type of clinically significant accessory renal artery was only encountered in about one-third of anatomical dissections.[19]

For healthcare professionals performing kidney transplantation, the presence of accessory renal arteries

(ARAs) is critically important. Research shows that patients with ARAs have a higher probability of complications, predominantly related to vascular problems like thrombosis and bleeding, particularly in cases of severe atherosclerosis, although there is not a significant difference in graft or patient survival between those with and without ARAs. Additionally, delayed graft function is more likely to happen in patients with ARAs.[15,20]

The CT-angiography study by Chettri et al.,[11] over 400 patients of Nepal, reported that renal artery variation was observed in 32.25% showing that most commonly 16.25% variation in the inferior pole artery, which was similar to our study. Another cadaveric study from India also suggests that 25% of cadavers exhibit variation primarily occurring as accessory renal artery (12.5%) and early branching (4.2%).[7] In addition to the renal vessels, Vladimirova's research team reported that in 30% cases, supernumerary arteries typically entering the kidney outside the hilum were found, which were often difficult to classify due to their variability.[21] Finally, the study of renal artery variation by Paudyal et al.,[22] over 125 patients from Nepal, reported that the most common type of variation was in hilar division (24%), followed by accessory renal artery 21.6% and aberrant renal 8.8%, highlighting the significant anatomical diversity in the Nepalese population.

During kidney transplantation, if surgical management is not done effectively, it could result in problems such as hydronephrosis, necrosis, or ureteral ischaemia. Furthermore, because of their impact on the renin-angiotensin-aldosterone system, ARAs are linked to resistant hypertension; therefore, a comprehensive study of their anatomy is essential for successful surgical intervention.[15,20]

Conclusion

The case study identifies the variation as a double accessory right renal artery, showing right inferior polar artery and right middle accessory hilar artery. The prevalence of renal artery variation is well documented, and its variation has a significant impact on surgical and interventional procedures. Recognition of this variant through cadaveric study and imaging is critical for safe surgical and radiological practice. The preoperative vascular mapping should be considered as standard before renal transplantation, complex urological procedures, and during vascular repairs.

Conflict of Interest

None.

Author Contributions

SS: conceptualization, data curation, formal analysis, investigation, methodology, supervision, writing original draft, writing review and editing; SC: formal analysis, investigation, methodology, project administration, supervision, writing review and editing; JAB: formal analysis, investigation, methodology, project administration, supervision, writing review and editing; SP: formal analysis, investigation, methodology, project administration.

Ethics Approval

Ethical clearance for this case report and the cadaveric images used in this study was granted by the Institutional Review Committee of National Medical College, affiliated with Tribhuvan University, recognized by the Nepal Medical Council and approved by the Ministry of Education, Government of Nepal (Regd. No: 11155/056/057; PAN No: 300516076). The study was conducted in full compliance with national ethical guidelines and institutional protocols for anatomical education. No personal identifiers are included, and all images adhere to ethical standards ensuring respect and dignity of human remains.

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References

1. Standring S. Gray's anatomy: the anatomical basis of clinical practice. 41st ed. London: Elsevier; 2016.
2. Khare S, Jain S, Tripathi A, Jain I, Raizaday S, Kausar H, Dawani P, Kaushik RK. Comprehensive study of anatomical variations of renal artery on human cadavers with its clinical significance. Journal of Anatomical Sciences 2021;29:58–62.
3. Budhiraja V, Rastogi R, Jain V, Bankwar V. Anatomical variations of renal artery and its clinical correlations: a cadaveric study from central India. Journal of Morphological Sciences 2013;30:228–33.
4. Bolatlı G, Ulusoy M, Koplay M, Acar M, Zararsız İ. Investigation of renal artery variations with multidetector computed tomography angiography technique. Black Sea Journal of Health Sciences 2021;4:22–5.
5. Sirikonda P, Mariya , Sugavasi R, Katikireddi RS. Variations in renal arteries- a cadaveric study in Telangana, India. International Journal of Anatomy Radiology and Surgery 2023;12:AO01–4.
6. Lama CP, Pradhan A. Variations of renal artery in cadavers. Nepal Med College Journal 2019;21:214–9.

7. Anturlikar V, Moolya P, Bhusari P, Satpute S, Patil D. A cadaveric study of variations of renal artery from Nashik, Maharashtra, India. Journal of Clinical Diagnostic Research 2022;16:AC05–9.
8. Mazzucchi E, Souza AA, Nahas WC, Antonopoulos IM, Piovesan AC, Arap S. Surgical complications after renal transplantation in grafts with multiple arteries. Int Braz J Urol 2005;31:125–30.
9. Khanehzad M, Seyfali E, Hajimomeni Y, Saeediniya E, Pasbakhsh P. A case report of renal artery variation. Anatomical Sciences Journal 2014;11:205–8.
10. Gupta A, Tello R. Accessory renal arteries are not related to hypertension risk: a review of MR angiography data. AJR Am J Roentgenol 2004;182:1521–4.
11. Chhetri PK, Basnet P, Adhikari A. Anatomical variations of renal artery in patients undergoing computed tomography of abdomen: a hospital-based cross-sectional study. Journal of Lumbini Medical College 2021;9:1–7.
12. Dingyang Lv, Huiyu Zhou, Fan Cui, Jie Wen, Weibing Shuang. Characterization of renal artery variation in patients with clear cell renal cell carcinoma and the predictive value of accessory renal artery in pathological grading of renal cell carcinoma: a retrospective and observational study. BMC Cancer 2023;23:274
13. Sampaio FJB, Passos MARF. Renal arteries: anatomic study for surgical and radiological practice. Surg Radiol Anat 1992;14:113–7.
14. Chauhan PA. Cadaveric Study of renal artery variation in Rajkot. Journal of Medical Science and Clinical Research 2016;4:10066–9.
15. Triantafyllou G, Paschopoulos I, Węgiel A, Olewnik Ł, Tsakotos G, Zielinska N, Piagkou M. The accessory renal arteries: a systematic review with meta−analysis. Clin Anat 2025;38:660–72.
16. Ozkan U, Oğuzkurt L, Tercan F, Kizilkiliç O, Koç Z, Koca N. Renal artery origins and variations: angiographic evaluation of 855 consecutive patients. Diagn Interv Radiol 2006;12:183–6.
17. Munnusamy K. Variations in branching pattern of renal artery in kidney donors using CT angiography. J Clin Diagn Res 2016;10: AC01–3.
18. Keibel, Franz, Mall FP. Manual of human embryology. Vol 2. Philadelphia (PA): JB Lippincott Company; 1912. 820–25 p.
19. Tremblay A. Renal artery variations clinical significance and implications. International Journal of Anatomical Variations 2024;17:675–6.
20. Zorgdrager M, Krikke C, Hofker SH, Leuvenink HGD, Pol RA. Multiple renal arteries in kidney transplantation: a systematic review and meta-analysis. Ann Transplant 2016;21:469–78.
21. Tivcheva YV, Angelov M, Krastev N, Kirilov C, Krastev D, Jelev L, Apostolov A. Polar and extrahilar renal arteries: a case report. Archives of Community Medicine and Public Health 2023;9:001–3.
22. Paudyal S, Kumar Gupta M, Adhikari D. Anatomical variations of renal artery studied by computed tomography in a tertiary care center in Nepal. International Journal of Health Sciences and Research 2023;13:268–73.

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