

ABERRANT RENAL ARTERIES AND THEIR CLINICAL SIGNIFICANCE

ALIA AMIN, NAZREEN SHARIF AND M. TAHIR

Departments of Anatomy, CMH Lahore Medical and Dental College and University of Health Sciences, Lahore

ABSTRACT

Introduction: Paired kidneys are located retroperitoneally in para-vertebral gutters and receive 20% of cardiac output. Each kidney is supplied by a single renal artery from aorta in 70% of individuals.

Objective: Identifying and reporting variations in renal vasculature. This was a case report, from CMH Lahore Medical College, Lahore.

Anatomical variations in the vascular pattern of kidneys have been well documented in medical literature. Aberrant renal arteries hold significant importance in diagnostic and therapeutic strategies. Knowing the possibilities of aberrant renal vessels, provides a better approach to radiological and surgical interventions in cases of nephrectomies, renal tumors, transplants and renal vascular disorders. In this milieu, present case is being reported to highlight multiple variations in renal vascular pattern. There was left sided accessory renal artery originating from aorta along with unusually long and little tortuous principal renal artery. There was hilar congestion due to complex arrangement of unusually long pre-hilar portion of segmental veins draining into short renal vein. On the right side extra-hilar (aberrant) renal arteries combined with complex branching pattern of renal arteries was observed in a 40 years old male cadaver, detected during dissection performed in routine gross anatomy course.

Key words: Kidney, Aberrant arteries, vasculature.

INTRODUCTION

Paired kidneys are located retroperitoneally in para-vertebral gutters and receive 20% of cardiac output. Each kidney is supplied by a single renal artery from aorta in 70% of individuals.¹

Previous studies have labeled additional renal vessels as accessory, aberrant, anomalous or supernumerary.² According to Graves³ the term 'aberrance' has been applied equally to additional artery along the normal renal pedicle, or to any polar artery. However Satyapal et al.⁴ defined accessory renal artery as a branch from aortic branches and additional renal artery as branch of aorta. According to Rao and Rachana⁵ an accessory renal artery is the one that is present in addition to the main renal artery and enters the kidney through hilum whereas aberrant renal artery supplies the kidney without entering its hilum.

During development of human embryo, lateral splanchnic arteries supplying the developing kidneys may persist as accessory renal or suprarenal arteries. These vessels may be bilateral or unilateral.⁶ Accessory renal arteries are common in 30% of individuals, and usually take origin from the aorta above or below the main renal artery.¹ Thomson⁷ in the report

of committee of collective investigations appointed by 'Anatomical Society of Great Britain and Ireland' documented the rate of renal vascular variations to be 25 – 26% of 419 bodies. Rarely, accessory renal arteries arise from the superior mesenteric arteries,⁸ inferior mesenteric artery,² coeliac and common iliac arteries.¹ Thorough knowledge of variations in vascular pattern is important to avoid iatrogenic injuries during surgical procedures.⁹

CASE REPORT

During routine dissection at Combined Military Hospital Medical College, multiple variations in number and branching pattern of renal arteries were observed in a 40 years old male cadaver with unknown medical history. Hilar region was carefully dissected and cleared.

On the Left Side

An accessory renal artery (inferior polar artery) was found on the left side. It was arising from the lateral aspect of abdominal aorta about 1.5 cm above the origin of inferior mesenteric artery. It coursed laterally on the left psoas major muscle passing under the left gonadal vessel and crossing over the upper

end of ureter to enter lower pole of kidney. The usual left hilar renal artery was comparatively long. It gave an apical branch as extra hilar artery entering the superior pole and entered the hilum showing little arched course. The actual length of renal vein proper was short and segmental tributaries of renal veins were unusual in having long pre hilar length and large size with complex arrangement leading to hilar congestion. Though, no remarkable finding was noticed regarding position and relations of kidney but surface was not smooth. It showed nodular appearance.

On the Right Side

Hilum of the kidney was facing little anteriorly in its upper part which could be due to mal – rotation of kidney during development. Right renal artery divided into 8 branches, out of which 3 branches originated from a common point of right renal artery and entered the upper pole separately. These can be called as apical aberrant / extra-hilar branches. The remaining 5 branches pierced the hilum. Unlike the left renal vein, right renal vein was leaving the hilum as a single vessel. Surface, position and relations of right kidney were normal.

DISCUSSION

Renal vasculature can show various patterns of aberrant renal arteries which are usually due to abnormal rotation or position of kidney.^{10,11} Superior renal polar arteries are usually single and arise from aorta or renal arteries.⁵ In this report, there were 3 superior extra-hilar branches arising from renal artery showing a rare pattern. Commonly extra hilar apical segmental artery does not divide unless it enters the kidney but rarely, it divides into leash of vessels piercing the superior pole separately.⁴ Incidence of inferior polar accessory arteries is twice to the superior polar arteries.¹² Sampaio and Passos¹³ found two hilar with one superior pole extra hilar branch in 9 out of 266 kidneys.

Accessory renal artery was found on the left side. Left sided preponderance of the accessory renal artery was also observed by Brodie et al.¹⁴ who found double renal arteries in 28 out of 273 cases more on the left side. This is also supported by the work of Satyapal et al.⁴ according to which the incidence of extra renal artery is more on left side (27.6%) than on the right side (18.6%) and they also observed the sex and race incidence to be 28% and 5.1% in males 16.4% and 3.8% in females. Recently, a study conducted by Gupta et al.¹⁵ has documented presence of two pre-caval right renal arteries and four left renal arteries arising from aorta.

These vascular variations may be associated with underlying renal pathologies. The abnormal divisions of renal artery at hilum can be associated with



Fig. 1: Left kidney: 1) renal artery, 2) apical segmental artery, 3) continuation of renal artery, 4) polar artery crossing ureter, 5) ureter, 6) origin of polar artery from aorta, 7) long segmental vein, 8) abnormal nodular surface of kidney, 9) Testicular vein.

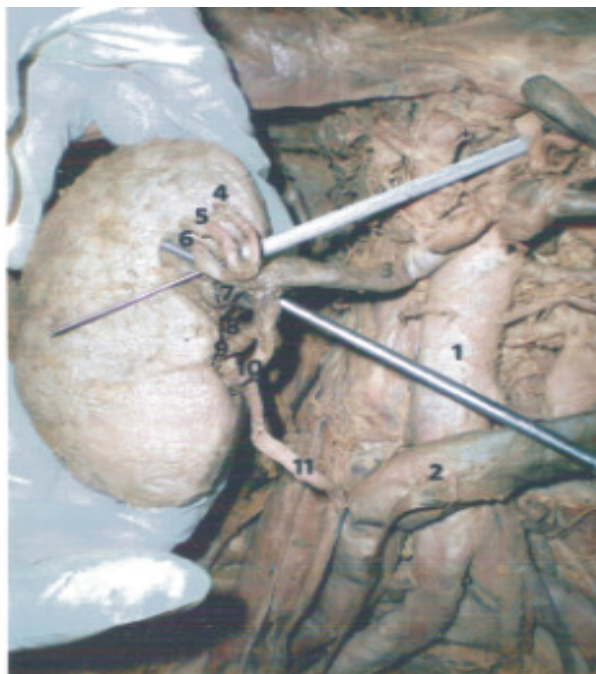


Fig. 2: Right kidney: 1) aorta, 2) reflected inferior vena cava, 3) renal artery, 4-6) extra-hilar branches of renal artery, 7) cut end of renal vein, 8-10) segmental branches of renal artery, 11) ureter.



Fig. 3: 1) Inferior vena cava, 2) left renal vein, 3) abdominal aorta, 4) left renal artery, 5) inferior polar artery, 6) ureter, 7) left gonadal, 8) aberrant renal arteries.

some embryonic renal malformations.^{10,16} Moreover, accessory renal artery, crossing and compressing the ureter, can lead to hydronephrosis.^{1,17} Rouviere et al.¹⁸ observed significant incidence of pelvic – ureteric obstruction in cases of abnormal course of renal vessels at hilum.

Knowledge of renal vascular anatomy holds prime importance in multiple advance diagnostic and surgical techniques as transplanting a kidney with single artery is easier and successful¹⁹ than kidney with multiple arteries, which is associated with more chances of infarction and hemorrhage.²⁰ Atypical vascular pattern of renal pedicle can lead to massive haemorrhage during surgical traction.¹² Another clinical significance of knowing the possible renal vascular variation is to avoid the surgical complications especially in laparoscopic surgeries in which surgeon have limited exposure has assistance.²¹ It can also influence the arteriographic reports and endovascular interventions.^{22,23}

It is **concluded** that identification of the variation in renal vascular patterns can be helpful in making renal surgeries uneventful and successful. Though a large number of renal vascular variations have been reported previously, this pattern of combined variations is not common but its knowledge is important that can be helpful in reducing the chances of any type of interventional complications in patients.

ACKNOWLEDGEMENTS

The authors are thankful to the administration of CMH Lahore Medical College for allowing the publication of this case report.

REFERENCES

1. Standring S. Gray's Anatomy; The Anatomical Basis of Clinical Practice 40th ed. Edinburg: Churchill and Livingstone, 2008: 1231-1233.
2. Loukas M, Aparicio S, Beck A, Calderon R, Kennedy M. Rare Case of Right Accessory Renal Artery Originating as a Common Trunk with the Inferior Mesenteric Artery: A Case Report. *Clin Anat* 2005; 18: 530-535.
3. Graves FT. The aberrant renal artery. *J Anat* 1956; 90: 553-558.
4. Satyapal KS, Haffejee AA, Singh B, Ramsaroop L, Robbins JV, Kalideen JM. "Additional renal arteries: incidence and morphometry," *Sur. Radiol. Anat.* 2001; 23 (1): 33-38.
5. Rao TR. Rachana. Aberrant renal arteries and its clinical significance: a case report. *Int J Anat Var* 2011; 4: 37-39.
6. Tanyelia E, Uzelb M, Soyluoglu AI. Complex renal vascular variation: A case report. *Ann Anat* 2006; 188: 455-458.
7. Thomson A. "Report of Committee of Collective Investigation appointed by the Anatomical Society of Great Britain and Ireland," *J Anat Phys* 1891; Vol. xxv.
8. Bamac B, Colak T, Ozbek A, Gundomus UN. A report of unusual origin of right renal artery. *Int. J Anat Var* 2011; 4: 95-97.
9. Morro RM, Lufukuja GJ, Fabian FM. Bilateral double ureters and accessory renal vessels in a Tanzanian male cadaver: a rare urinary system variation. *Int J Anat var* 2010; 4: 164-166.
10. Bayramoglu A, Demiryurek D, Erbil KM. "Bilateral additional renal arteries and an additional right renal vein associated with unrotated kidneys," *Saudi Med J* 2003; 25 (4): 535-537.
11. Kumar, N., Aithal AP, Guru A, Nayak SB. Bilateral Vascular Variations at the Renal Hilum: A Case Report. *In Vasc. Med* 2012; Vol. 2012, Article ID 968506.
12. Weinstein BB, Coun-riss EH, Derges VJ. The renal vessels in 203 cadavers. *Urol. Cutan. Rev.*, 1940; 44: 137-139.
13. Sampaio FJ, Passos MA. Renal arteries: anatomic study for surgical and radiological practice. *Surg. Radiol Anat* 1992; 14: 113-117.
14. Bordei P, Sapte E, Iliescu D. Double renal arteries originating from the aorta. *Surg. Radiol Anat* 2004; 26: 474-479.
15. Gupta A, Kumar P, Soni G, Shukla L. Double precaval right renal artery associated with multiple left renal arteries: a rare case report. *Int J Anat Var* 2011; 4: 137-138.
16. Graves FT. The arterial anatomy of the congenitally abnormal kidney. *Br. J Surg* 1969; 56: 533-541.
17. Patasi B, Boozary A. A case report: accessory right renal artery. *Int J Anat Var* 2009; 2: 119-121.
18. Rouviere O, Lyonnet D, Berger P, Pangaud C, Gelet A, Martin X. Ureteropelvic junction obstruction: Use of helical CT for preoperative assessment – comparison with intra-arterial angiography. *Radiol* 1999; 213 (3): 668-673.
19. Ozkan U, Oguzkurt L, Tercan F, Kizilkilic O, Koc Z, Koca N. Renal artery origins and variations: Angiographic evaluation of 855 consecutive patients. *Diagn. Interv. Radiol* 2006; 12: 183-186.
20. Coen LD, Raftery AT. Anatomical variations of the renal arteries and renal transplantation. *Clin Anat* 1992; 5: 425-432.
21. Kawamoto S, Montgomery RA, Lawler LP, Horton KM, Fishman EK. Multi-detector row CT evaluation of

- living renal donors prior to laparoscopic nephrectomy. *Radiographics* 2004; 24: 453-466.
22. Pennington, N., Pennington, N., Soames, R.W. The anterior visceral branches of the abdominal aorta and their relationship to the renal arteries. *Surg Radiol Anat* 2005; 27: 395-403.
23. Kaneko N, Kobayashi Y, Okada Y, Anatomic variations of the renal vessels pertinent to trans-peritoneal vascular control in the management of trauma. *Surgery* 2008; 143: 616-22.