

Clinical Aspects of Renal Artery Variations

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ABSTRACT

Amongst large number of anatomical variations in the vascularization of the kidney, the most common variation is the occurrence of multiple renal arteries. The arteries play an important role in the circulatory system as they carry a large portion of blood to the kidneys. Due to very high incidence of such variations reported by previous studies, current study was conducted to observe incidence of such variations in renal arteries among North West Indian population. Accessory renal arteries, which are the most common and clinically important variations of the renal circulatory system, are encountered in approximately one third of anatomic dissection series. In the current study, the formalin fixed forty cadavers were dissected in department of Anatomy, PGIMER, Chandigarh. Then, kidneys along with their arteries were explored and the morphological variations of renal arteries were observed. Authors in current study observed maximum incidence of origin of RA at the level of L1 (right side - 86%; left side - 80%). It was observed that in 70% of the cases, right renal artery ostium was lying cranial to that of left renal artery, in 24% cases, left renal artery ostium cranial to that of right ostium and in 6% both the ostia were seen lying at symmetrical levels. In all the cases, diameter of accessory renal arteries was found to be narrower than that of main renal artery. In one case, we observed a variation in the arrangement of structures at hilum of kidney. Renal vein was seen compressed between the branches of renal artery. Our results present a significant high variation in occurrence of different forms of multiple renal arteries in Indian population in comparison to other populations.

Key words: artery; renal; accessory; variation; vascular

Introduction

According to typical textbook description, the paired renal artery (RA) originates from the lateral wall of aorta just below the origin of superior mesenteric artery (SMA) at the level of intervertebral disc between the L1 and L2 vertebrae (1, 2). The arteries play an important role in the circulatory system as they carry a large portion of blood to the kidneys. The arteries normally arise off the sides of the abdominal aorta (3). Narrowing of the renal arteries may result in

hypertension. The arteries may also be affected by diseases such as aneurysm and atherosclerosis which usually cause alteration in their luminal diameter (4). Many variations have been observed in vertebral origin of RA varying from from T12 to L4 vertebral levels (5, 6). Similarly, ostium of right RA lies cranial to that of left RA according to typical description. However, in 49.1% - 65% cases, left RA ostium has been observed to be lying cranial to that of right one (7, 8). Ectopic origins of RA have also been reported.

The diameter of the RA varies from 3 to 9 mm (1). In case of accessory renal vessels, their caliber has been observed to be narrower than that of the main renal vessel (3 - 5.5 mm) by most of the studies (5). Similarly, the length of RA has been observed to be varying from 3 to 5 cm with right RA longer than left one in most of the cases (1, 5). Similarly, right accessory RA (5.6 cm) was found to be longer than that of left one (4.5 cm). RA may give rise to branches normally derived from other vessels, such as inferior phrenic artery, hepatic artery, gonadal artery etc. Thus, due to very high incidence of such variations reported by previous studies, current study was conducted to observe incidence of such variations in renal arteries among North West Indian population. Accessory renal arteries, which are the most common and clinically important variations of the renal circulatory system, are encountered in approximately one third of anatomic dissection series. Detection of these accessory arteries is of great importance when the accurate depiction of renal arterial anatomic structures is required, such as in cases of renal transplantation, surgical reconstruction of the abdominal aorta, and renovascular hypertension. **Material & methods**

The formalin fixed forty cadavers were dissected in department of Anatomy, PGIMER, Chandigarh. First of all, skin, underlying muscles and other viscera were removed and preserved for teaching purpose. Then, kidneys along with their arteries were explored and the morphological variations of renal arteries were observed. Aims of the study were to observe variations in relation to origin, relative position of both arteries in relation to each other, their number, branching pattern, their dimensions like length and

diameter and their branches. The aortic branches of larger caliber were called renal arteries.

Results

Authors in current study observed maximum incidence of origin of RA at the level of L1 (right side - 86%; left side - 80%). In rest of the cases, authors found origin at different levels varying from T12 (right side - 2%), L1-L2 (right side - 2%; left side - 4%), L2 (right side - 10%; left side - 10%) and L3 vertebral level (left side - 6%). We observed that in 70% of the cases, right renal artery ostium was lying cranial to that of left renal artery. However, in 24% cases (Figure 1), left renal artery ostium was observed lying cranial to that of right renal artery ostium and in rest of the cases (6%), both the ostia were seen lying at symmetrical levels.

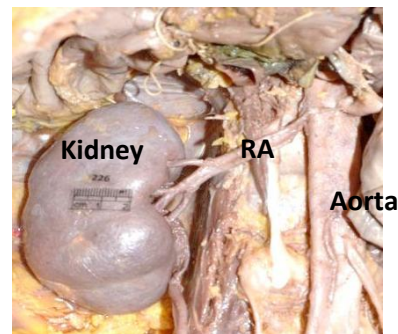


Figure. 1 Figure showing position of left renal artery (RA) cranial to that of right RA

As far as origin of artery is concerned, in all the cases, we found renal artery to be originating from abdominal aorta. We did not find any case with ectopic origin of renal artery. Regarding dimensions of renal arteries, in the current study, we observed that diameter of main renal artery was 8 mm bilaterally. Similarly, we observed the diameter of accessory renal arteries. In all the cases, diameter of accessory renal

arteries was found to be narrower than that of main renal artery (Figure 2).

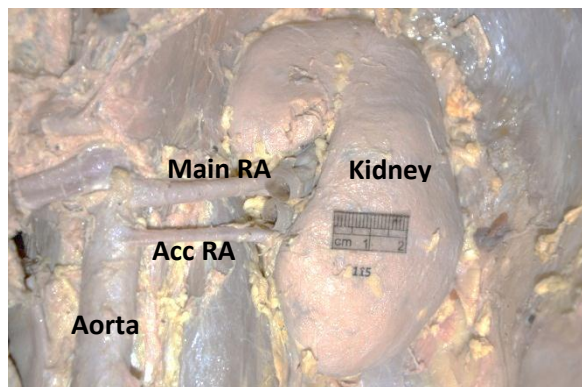


Figure 2 As shown in figure, diameter of accessory renal artery (acc RA) is less than that of main RA

Length of renal artery was found to be 5.8 cm on right side and 5.3 cm on left side. Authors in current study, reported higher incidence of accessory RA on left side (28%) than on right side (18%). In one case, we observed a variation in the arrangement of structures at hilum of kidney. Renal vein was seen compressed between the branches of renal artery (Figure 3).

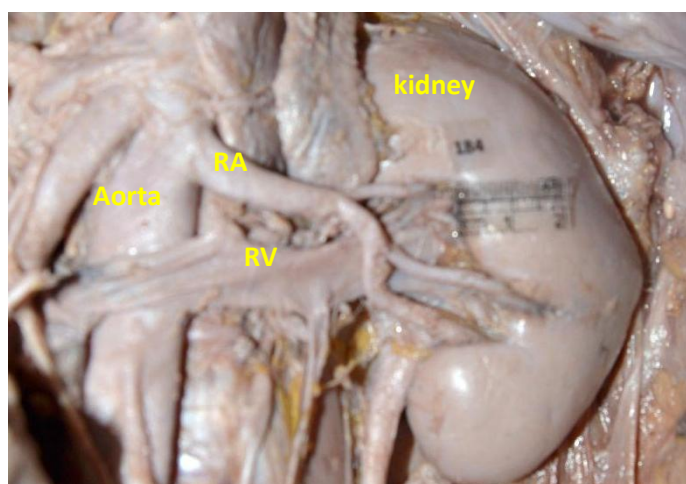


Figure 3 Figure showing renal vein (RV) compressed within branches of renal artery (RA)

Discussion

Amongst large number of anatomical variations in the vascularization of the kidney, the most common variation is the occurrence of multiple renal arteries. We believe that awareness of variations is necessary for surgical management during renal transplantation, repair of abdominal aorta aneurysm, urological procedures and for angiographic interventions (9). Obstruction of any renal artery leads to cessation of function and death of the part of kidney supplied by it as all these are end arteries. Hence the term accessory is misleading because they are not extra but essential tissue sustaining arteries without anastomosis between them, which correspond to the segmental branches of a single renal artery (10). Some of the previous studies have reported symmetrical emergence of both RA in 10% to 50% cases (8, 11). However, authors in the current study observed quite low incidence of such variation (6%). The incidence of accessory RA has been reported to be approximately 25-30% (2). Authors in current study, reported higher incidence of accessory RA on left side (28%) than on right side (18%). Normally, RA courses behind inferior vena cava (IVC). However, according to some studies in more than one third of cases, right RA was seen to be lying anteriorly and criss crossed with the right renal vein (12). In the current study, in one case authors observed IVC lying compressed within the branches of RA. Our results present a significant high variation in occurrence of different forms of multiple renal arteries in Indian population in comparison to other populations.

References

1. Anson BJ. The cardiovascular system- arteries and veins. In Morris Human anatomy, 12th Edition.

- The Blakiston Division McGraw Hill book Company, New York.1966; 741.
2. Williams PL, Warwick R, Dyson M, Bannister LH, editors. 1989. Gray's anatomy. 37th ed. Edinburgh, London, and New York: Churchill Livingstone.
 3. Ozkan U. Oguzkurt L. Tercan F. Kizilkilic O. Koc Z. Koca N. Renal artery origins and variations: Angiographic evaluation of 855 consecutive patients. Diagnostic InterventionalRadiology, 2005; 12:183-189.
 4. Kem L. Daniel F. Renin-dependent aberrant hypertension caused by nonfocalstenotic aberrant hypertension. American Heart Association, 2005; 46(2): 380-385.
 5. Alghizzi HJK. 2011. The variation of RA anatomy in the Iraqi population: An angiographic study of 358 middle Euphrates Iraqi patients attending the catheterization laboratory in Hilla province Karbala J. Med 4(1,2).
 6. Kadir S. 1991. In: Kadir, S. (Ed.). Atlas of normal and variant angiographic anatomy. Philadelphia: W.B. Saunders Company, p. 387-429.
 7. Garcier JM, De Fraissinette B, Filaire M, Gayard P, Therre T, Ravel A. 2001. Origin and initial course of the RA: a radiological study. SurgRadiolAnat 23:51-55.
 8. Saldarriaga B, Pinto SA, Ballesteros LE. 2008. Morphological Expression of the RA: A Direct Anatomical Study in a Colombian Half-caste Population. Int J Morphol 26:31-38.
 9. Budhiraja V, Rastogi R, Asthana AK. 2011 Folia Morphol (warsz) 70: 24-28.
 10. Sampaio FJ, Passos MA. 1992. Renal artery: anatomic study for surgical and radiologicalpractice. SurgRadiolAnat 14:113-117.
 11. Keen EN. 1981. Origin of RA from the aorta. ActaAnat(Basel) 110:285-6.
 12. Testut L, Latarjet A. 1958. Tratado de Anatomia Humana, Salvat, Barcelona, Spain, 9th edn, vol. 2.

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