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Case Report

Accessory renal arteries: a case report

Billakanti Prakash Babu*, Anjali Roy, Hemalatha Bangera

Department of Anatomy, Kasturba Medical College, Manipal University, Manipal - 576104, Karnataka, India

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***Correspondence:**
Dr. Billakanti Prakash Babu,
E-mail: billakantibabu@yahoo.co.in

ABSTRACT

During dissection of abdomen by the undergraduate medical students three accessory renal arteries were observed on the right side. The superior accessory artery was a small vessel arising from aorta just above the normal renal artery. It entered the anterior surface of kidney just below the upper pole. The middle and inferior arteries were caudal to the normal renal artery. The middle artery was arising from testicular artery and entered the anterior surface of kidney below the hilum. The inferior artery was arising from aorta just above its bifurcations and entered the lower pole of kidney. The importance of accessory renal arteries in surgical procedures of the posterior abdominal wall and renal transplantation are discussed.

Keywords: Accessory renal arteries, Renal arteries, Renal transplantation

INTRODUCTION

The renal arteries arise from lateral aspect of the abdominal aorta below the level of superior mesenteric artery at the level of L1 vertebra.[1,2] The right renal artery is longer in its course owing to the location of the abdominal aorta more towards the left side of midline. It passes posterior to the inferior venacava. The left renal artery arises a little lower down and passes behind the left renal vein. Each renal artery divides into anterior and posterior divisions at or very close to the hilum of the kidney. Further it divides into segmental arteries to supply different renal segments which are end arteries.

Variations in the course, number; source, branching pattern of the renal arteries are common. The accessory renal arteries account for about 30% of variations and 70% belong to the normal type as per the available literature.[3-5] These arteries represent the persistent fetal mesonephric branches of the dorsal aorta.[6] Knowledge and awareness of these possible variations and anomalies of the renal arteries are necessary for sufficient surgical management during renal transplantation, repair of abdominal aorta aneurysm, renal pathologies, urological procedures, radiological and angiographic interventions and other surgical approaches on them. There might be altered state of hemodynamics in cases of multiple arteries supplying it.[3,4,7]

CASE REPORT

During dissection of abdomen by the undergraduate medical students in Kasturba medical college, Manipal, Karnataka in a male cadaver three accessory renal arteries were observed on the right side arising from abdominal aorta (Figure 1). The superior accessory artery was a small vessel arising from aorta just above the normal renal artery. It entered the anterior surface of kidney just below the upper pole. The middle and inferior arteries were caudal to the normal renal artery. The middle accessory artery was seen crossing anterior to right testicular vein and ureter and entered the anterior surface of kidney below the hilum and was giving testicular artery during its course. The inferior artery was arising from aorta just above its bifurcation into common iliac arteries crossing behind right testicular vessels it entered

the lower pole of kidney. However, no variations were found in the renal artery on the left side.

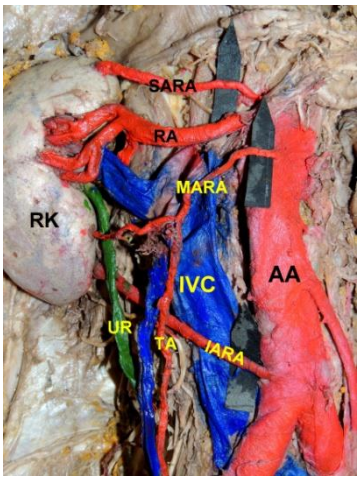

Figure 1: Three accessory renal arteries on the right side arising from abdominal aorta in a male cadaver.

DISCUSSION

Variations in the origin, course and branches of renal artery are well documented in the literature. Clinically accessory renal arteries constitute one of the most common vascular variant. Accessory renal arteries vary in size and are generally derived from the abdominal aorta (9-76%) and may enter the kidney at any point. Very rarely, the lower renal artery arises near the aortic bifurcation or from the common iliac artery. Sometimes one of the arteries passes in front of or behind the renal pelvis; the upper may cross the lower renal and the ureter pelvic junction to enter the inferior pole of the kidney. The presence of four renal hilar arteries derived from the aorta is rare. This pattern arises from the aorta between the superior and inferior mesenteric arteries. The upper two vessels may have a postcaval course and the lower may pass in front of the renal pelvis and the lower two behind it.[8]

Sometimes these accessory arteries can arise from aorta as high as the inferior phrenic arteries or as low as the internal iliac arteries. Rarely, accessory renal arteries may arise from aorta, as well as from the celiac or superior or inferior mesenteric arteries or gonadal or near the aortic bifurcation or from the common iliac arteries.[8] Broadly around 70% of cases showed a single renal artery while 30% -35 % showed accessory renal arteries supplying the kidney.[1]

Renal arteries develop from lateral splanchnic arteries which form a network on either side of the aorta. An accessory artery or arteries passing to the superior or inferior renal poles are regarded as persistent embryonic lateral splanchnic arteries.[9] Atasver et al., (1992)[10] reported that the accessory arteries usually enter the renal cortex at one of the poles. Lower polar accessory arteries tend to be larger than upper ones because they generally represent the inferior polar artery and are usually derived directly from the aorta.

Abolhassan B et al., (2007)[11] reported the presence of accessory renal artery bilaterally on digital subtraction angiography performed on a renal transplant donor. Two renal arteries were arising from the aorta on the right side. One was a normal hilar artery and second was the lower polar artery. Left accessory renal artery simultaneously supplied upper and lower pole by replacing the upper / apical and lower segmental artery. Main renal artery divided in to anterior and posterior segmental arteries.

Janschek EC et al., (2004)[12] reported incidences of multiple accessory renal arteries is 20.2% and 19% on right and left sides, respectively.

Beata Patasi et al., (2009)[13] reports single accessory right renal artery from abdominal aorta entering lower pole at the same point of exit of renal vein

Saldarriaga B et al. (2008)[14] reported 97 kidneys having accessory arteries out of 390 cases (24.9%). Out of these 87 (22.3%) had one additional artery and 10 (2.6%) had two additional arteries. The frequency of one additional artery was 43.5%on the right side and 56.3% on the left side.

Incidence of reported additional renal arteries has a wide range between 8.7% and 75.7%, and they can cause hydronephrosis by compressing the ureter.[15]

S Bindhu et al., (2010)[16] described three arterial variations on the right side - presence of accessory renal artery arising from the abdominal aorta, the testicular artery arising from the accessory renal artery and the obturator artery arising from the posterior division of internal iliac artery.

Hemanth Kommuru et al., (2012)[17] studied 182 kidneys. 34 kidneys showed presence of one additional artery, two additional arteries were seen in 18 kidneys; extra artery was present unilaterally in 6 cadavers and bilaterally in 20 cadavers. 23 kidneys showed presence of superior polar artery and 29 kidneys showed inferior polar artery. They also mentioned that in one of the cases the accessory renal artery was a branch of superior mesenteric artery.

The aberrant or accessory renal arteries to any of the poles of the kidney can be considered as segmental vessels. They are due to persistence of fetal renal vessels.[18]

Arteries entering the upper or lower pole of kidney are termed as "polar arteries''.[19] Polar vessels have been considered as segmental arteries supplying a particular segment of the kidney.[20] Satheesha Nayak et al., (2008)[21] found an extra inferior polar artery on left side.

Abdominal aorta also showed a kink at the level of origin of renal arteries. Availability of huge amount of data about the presence of multiple renal arteries, categorized as accessory, aberrant or additional, presence of extra renal arteries unilaterally or bilaterally, superior and inferior polar arteries, necessarily warrants the importance of a uniform and internationally acceptable nomenclature and classification of renal arteries. Other factors like genetic background, oxygenation and hemodynamic changes may also account for presence of accessory renal artery. Recent reports have also associated galactosemia with renal vascular anomalies.[22]

Supernumerary renal vessels occur in about 30% of kidneys. Two to four in number and of equal frequency as to sides, they disperse along the aorta from the eleventh thoracic to the fourth lumbar vertebra. Usually parallel, they enter the hilum in sequence and may be precaval or postcaval in position. These are renal segmented arteries whose origin is more proximal than the normal. Incidence of the multiple arteries has been reported to be about 20.2% on the right side and 19% on the left side.[23]

Presence of accessory renal arteries cans be explained in the light of development and its molecular regulation. Each primitive dorsal aorta gives off ventral splanchnic arteries, lateral splanchnic arteries, somatic arteries and caudal continuation. The lateral splanchnic arteries supply, on each side, the mesonephros, metanephros, the testis or ovary and the suprarenal gland. All these structures develop, in whole or in part, from the intermediate mesnchyme of the mesonephric ridge. One testicular or ovarian artery and three suprarenal arteries persist on each side. The inferior phrenic artery is a branch from the most cranial suprarenal artery and may be considered as a branch of persistent lateral splanchnic arteries. Persistence of lateral splanchnic arteries in the form of accessory renal arteries maybe attributed to misexpression of any of these transcription factors and signaling molecules as such as GF, TGFb, PDGF, SHH and EphB2.[24]

The knowledge of this potential anomaly is important for surgical procedures related to the posterior abdominal wall, renal transplantation, abdominal aorta aneurysm, ureter surgery and angiographic interventions. Although it is very rare, fibro muscular dysplasia in an accessory renal artery can be responsible for renovascular hypertension. Selective renal angiography should be performed as the “gold standard” test when renovascular intervention is considered. Multiple renal arteries is related to segmental arteries, so the risk of bleeding during surgery on kidney or renal transplantation, increases.[25] Lately, the demand for kidney donation has rapidly increased, so it is essential to be aware of the possibility of donors having multiple renal arteries. In order to precisely plan the surgical procedures and to avoid any vascular complications, arteriography should be performed earlier.[26,27]

CONCLUSION

Inferior accessory renal artery in our case passed superficial to ureter and testicular vein on right side and hence can lead to partial obstruction of ureter leading to hydronephrosis or testicular vein predisposing to varicocoele. Surgeons should exclude the possibility of presence of such accessory renal arteries obstructing ureter or testicular vein prior to the surgical treatment of hydronephrosis and varicocoele. Surgeons performing renal transplant need to have prior anatomical knowledge of normal renal vasculature and also accessory renal arteries in order to perform successful graft. It has been described that failure to restore circulation in accessory renal artery after surgery may cause unnecessary ischemia or necrosis of renal tissue. The present case highlights presence of three accessory renal arteries entering and supplying the anterior surface and lower pole of kidney. The awareness about the presence of such variations important from the academic, surgical and radiological point of view especially in anticipating pre and postoperative bleeding.

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