CASE REPORT

Rare variation: multiple renal arteries in left kidney

Shashikala Patel, Anshuman Naik

Abstract:
Proper knowledge of variation of arteries supplying the kidney is essential not only to the anatomists but also to the surgeons. The present case shows unilateral left multiple renal arteries in 54 year old male cadaver during routine dissection of abdomen. Micro-vascular techniques for renal transplantation surgeries require a thorough anatomical knowledge of accessory or multiple renal arteries for better outcome. So, study of renal vascular variation is important for its various clinical implications.
The end stage renal disease very common now-a-days requiring initial dialysis and patient ultimately endup on renal transplantation. The success of renal transplantation depends on family donor with no comorbidities and prefereably young age.
The success also depends on surgical technique and surgeons experience. The surgeon should have a vast experience and have to give due care to anomalous renal vessels.
All good centeres of renal transplantation depends on the vast experience of transplant surgeon and giving the due care to vascular anomalies improves the result of renal transplantation

Key Words: kidney, renal artery, anatomical variation, multiple, unilateral

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Introduction:
The renal arteries usually arise from the anterolateral or lateral aspect of the abdominal aorta just below the origin of the superior mesenteric artery at the level of L1 vertebra[1]. Near the hilum of the kidney, each renal artery divides into anterior and posterior branch, which in turn divides into a number of segmental arteries supplying the different renal segments[2]. Classically, a single renal artery supplies each kidney[3]. An artery arising from Aorta in addition to main renal artery is called as accessory renal artery. An artery arising from sources other than aorta is called as aberrant renal artery[4]. Among renal morphological variations, those most often encountered are variations in the number of the renal arteries, of which multiple renal arteries are the most frequent[5]. Explanation for individual or combined variations of renal arteries had been related to the embryological development of vessels from the lateral mesonephric branches of the dorsal aorta[6]. Knowledge of the variations of renal vascular anatomy has importance in exploration and treatment of renal trauma, renal transplantation, renovascular hypertension, renal artery embolization, angioplasty or vascular reconstruction for congenital and acquired lesions, surgery for abdominal aortic aneurysm and conservative or radical renal surgery[7]. The objective of the case report and review of literature is to bring awareness to clinicians about the variations in the blood supply of the kidney especially those who are performing invasive procedures and vascular surgeries on kidney.

The case showed unilateral left multiple renal arteries in 54 year old male cadaver during routine dissection of abdomen in Department of Anatomy. Abdomen was dissected as follows – A vertical incision on the anterior abdominal wall was given extending from xiphisternum to the pubic symphysis. The musculocuataneous flaps were reflected and the abdominal cavity was opened. After opening the abdominal cavity, both large and small intestines were removed

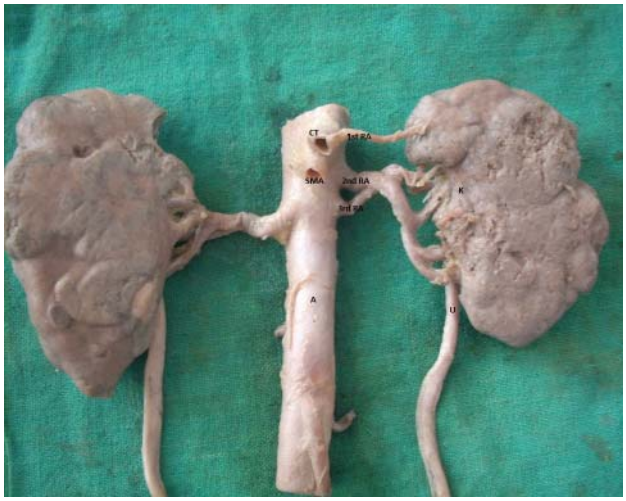

Fig.1:*left kidney showing multiple renal artery. (A: Aorta; CT: coeliak trunk; SMA: superior mesentry artery; 1st RA: 1st renal artery; 2nd RA : 2nd renal artery; 3rd RA:3rd renal artery; K: kidney; U: ureter;)*

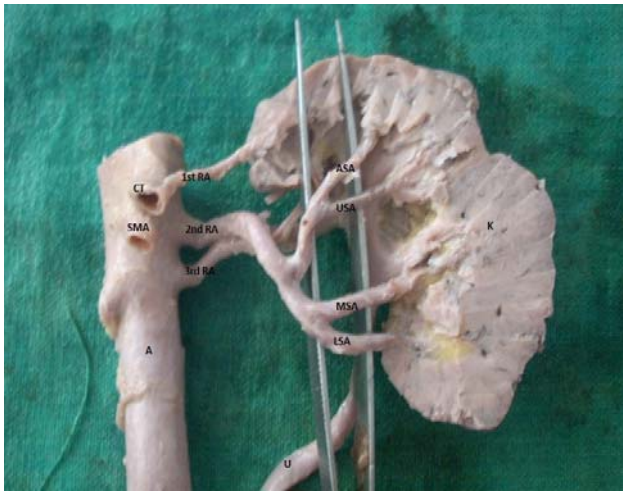

Fig.2: *dissected left kidney showing , anterior segmental branches of 2nd renal artery and polar branch of 1st renal artery. (A:Aorta; CT:coeliak trunk ; SMA: superior mesentery artery; 1st RA: 1st renal artery; 2nd RA : 2nd renal artery; 3rd RA:3rd renal artery; ASA: apical segmental artery; USA: upper segmental artery; MSA: middle segmental artery; LSA: lower segmental artery; K: kidney; U: ureter)*

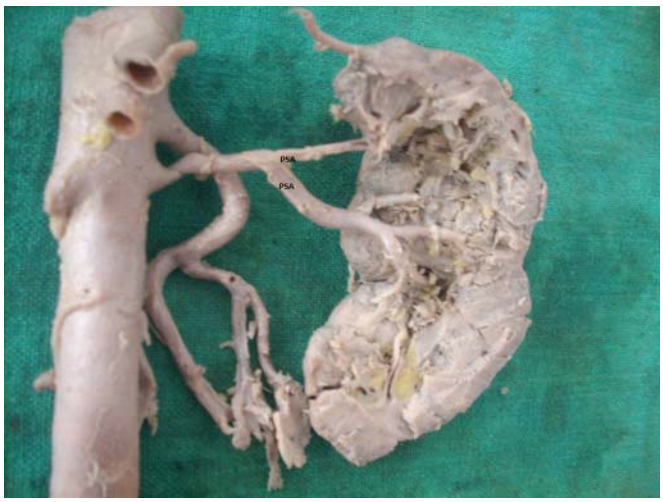

Fig.3: *dissected left kidney showing , posterior segmental branches of 3rd renal artery (PSA: posterior segmental artery)*

and the structures close to posterior abdominal wall were dissected[8]. All the paired and unpaired branches of the abdominal aorta were studied. In addition to normal branches multiple renal arteries were observed on the left side supplying the left kidney. 1st additional renal artery arised from celiac trunck at the level of T12 vertebra so it's called aberrant renal artery it ran laterally and supply to upper pole of left kidney without any division, 2nd renal artery arised from aorta ,1cm below from aberrant renal artery and lateral to the superior mesentery artery at the level of L1 vertebra, it ran laterally crossed anteriorly to 3rd renal artery and entered within the kidney through the hilum without anterior and posterior divisions, within the kidney it gave 4 segmental branches (1apical 1upper, 1 middle, 1 lower) whereas 3rd renal artery arised from 2cm below from aberrant renal artery it ran laterally and crossed by 2nd renal artery anteriorly and it entered within the kidney with anterior and posterior division at the hilum and it gave 2 posterior segmental arteries.

Discussion:

Most of the abnormalities of renal artery are due to changing position of kidney as a part of its normal development and ascent[9]. The kidney begins their development in pelvic cavity. During further development they ascend to lumber region which is their final position. When they are in pelvic cavity they are supplied by internal iliac artery or common iliac artery. While the kidney ascends to lumber region their arterial supply also shifts from common iliac to abdominal aorta.[10] Thus knowledge of embryology of renal vasculature and its development is essential in order tom understand the possibilities of multiple anomalies and variations in renal arteries[9]. Different variations in the origin, courses and branches of renal arteries have been described by many researchers and authors. In a study by Ozkan et al., a single renal artery was present in both kidneys in 76% of patients.

Renal artery variations included multiple arteries in 24%, bilateral multiple arteries in 5%, and early division in 8% of the cases. Additional renal arteries on the right side were found in 16% and on the left side in 13% of cases. Of all the extra renal arteries, the percentage of accessory and aberrant renal arteries were 49% and 51%, respectively[11]. However, Yeh et al, described presence of precaval right arteries in nine out of 186 patients by using spiral CT, and reported the prevalence rate to be 5%[12]. The frequency of renal artery variations shows social, ethnic and racial differences[13]. Gupta et al, mentioned two precaval RRAs and four left renal arteries[14]. In present case we also found two precaval RRAs which may lead Kaneko et al, from their study of 170 cases, found that 36 of 170 subjects (21.2%) had multiple arterial origins on the left or right side, and 8 subjects (4.7%) had bilateral multiple arterial origins[15]. Raheem et al. also mentioned that multiple renal arteries are more frequent on the left side than the right and may reach up to five in number[16]. Interestingly, in the present case we found four RRAs, five left renal arteries and there was a crossing between the 3rd and 4th arteries on left side, which may lead to compression of one of the arteries to compression of the IVC. Gupta et al. reported three and two renal arteries in right and left sides, respectively. The upper RRA arose at the level just below the superior mesenteric artery, before going to the kidney is divided into three branches. The lower renal artery was seen arising from the aorta just below the origin of inferior mesentery artery[17].

FJB Sampaio 1992 dissected 266 kidneys. 53.3% had single renal artery. Two hilar arteries in 7.3% and three hilar arteries in 1.9% . One hilar and one superior polar artery together in 14.3%, superior polar artery in 6.8%, inferior polar artery in 5.3% and other variations in 8.5%[18]. K.S. Satyapal 2001 found that out of 130 renal angiograms and 32 cadavers, kidneys showed presence of one additional renal artery in 23.2% and two additional renal arteries in 4.5%. They were seen more commonly on left side 32% as compared to 23.3% on right side. Presence of one additional renal artery was seen bilaterally in 10. 2%[19].
K Khamanarong 2004 found single hilar artery in 82%, double in 17%, (this includes 7% of upper polar arteries and 3% of lower polar arteries.) & three renal arteries in 1%[17]. (2.2%) and 3 (1.1%) triple renal artery[20].

With the increasing demand for kidney transplantation, living donor grafts has become the major source for maintaining the donor pool, and successful allograft with triple arteries has become a necessity. Nevertheless, to plan the adequate surgical procedure and to avoid any vascular complication, arteriography should be performed prior to every nephrectomy[3]. The variations described in the current observation present a unique pattern of congenital renal vascular variants having surgical and radiological importance.

Conclusion:
Multiple renal arteries is a result of congenital anomalies, this variations is very important for surgeons and Anatomist because this variation increases complexity of renal transplantation and it also responsible for higher range of kidney transplant failure.

List of abbreviations used in figure
Figure 1: left kidney showing multiple renal artery. (A:Aorta; CT:coeliak trunk ; SMA:superior mesentry artery; 1st RA: 1st renal artery; 2nd RA: 2nd renal artery; 3rd RA:3rd renal artery; K: kidney; U: ureter)
Figure 2: dissected left kidney showing , anterior segmental branches of 2nd renal artery and polar branch of 1st renal artery. (A:Aorta; CT :coeliak trunk ; SMA: superior mesentery artery; 1st RA: 1st renal artery; 2nd RA: 2nd renal artery; 3rd RA:3rd renal artery; ASA: apical segmental artery; USA: upper segmental artery; MSA: middle segmental artery; LSA: lower segmental artery; K: kidney; U: ureter)
Figure 3: dissected left kidney showing, posterior segmental branches of 3rd renal artery (PSA: posterior segmental artery)

Conflict of interest: none

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Role and contribution of authors:

Dr Shashikala Patel, Assistant Professor in Anatomy, did wrote the initial writeup and collected the data

Dr Anshuman Naik, Assistant Professor in Physiology, helped in collecting the references and critically review the article

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