*Bratisl Lek Listy 2008; 109 (4)*
182 – 184

CASE REPORT

# Anomalous renal arteries and its clinical implications

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**Abstract:** Often, the accessory renal arteries are observed near the hilum. Presence of anomalous accessory renal arteries may be associated with other underlying renal pathological conditions. We detected anomalous pattern of the renal arteries, in a 51 year old male cadaver, during routine undergraduate teaching program, in the department of Anatomy. The left renal artery originated at the level of the second lumbar vertebra and gave off two branches and each branch bifurcated into two branches which were destined to supply the suprarenal gland and the left kidney. However, the right renal artery displayed an early extra-renal division into two branches. The upper branch was found traversing to the upper pole, whereas the lower branch reached renal hilum by passing posterior to the renal pelvis. Anatomical description of this anomalous pattern of renal vasculature is presented in this case report, highlighting its clinical implications *(Fig. 2, Ref. 10)*. Full Text (Free, PDF) www.bmj.sk.
Key words: kidney, renal, artery, vein, vasculature, abdominal aorta, multiple, nephrectomies, anomalies, abnormalities.

The renal arteries on each side, arise from the abdominal aorta below the origin of the superior mesenteric artery (1). Near the hilum of the kidney each renal artery divides into an anterior and posterior branch which in turn divide into number of segmental arteries supplying the different renal vascular segments (1). The presence of anomalous branching pattern of the renal arteries is not uncommon. In 70 % of cases, there is a single renal artery supplying each kidney (1). Considering this fact, multiple branching pattern of the renal arteries may not be uncommon finding, the clinical implications of such an anomaly need to be given due attention.

Blood circulation through the renal arteries in case of multiple branching pattern may result in altered hemodynamics. Often, the existence of renal pathology, may have to be thoroughly investigated for any underlying vascular malformation. Surgeons operating on the kidney must be acquainted with the normal and abnormal anatomy of the renal vessels to avoid any inadvertent injury. It is also important for radiologists to be aware of such renal vasculature anomalies especially while performing renal angiography.

In the present study, we report an anomalous pattern of renal artery in an adult male cadaver. We as anatomists, feel that presence of accessory and anomalous branching pattern of the renal arteries, may be important from academic and clinical viewpoint.

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## Case report

During the course of undergraduate medical teaching program in the department of Anatomy, we observed anomalous branching pattern of the renal arteries in a 51 year male cadaver. The anomalous renal vasculature was studied in detail and the specimen was photographed (Figs 1 and 2).

## Observations

The left renal artery (‘LRA’ in Figure 1) originated from the abdominal aorta at the level of second lumbar vertebra and gave a branch (‘1’ in Figure 1). Another accessory artery (‘2’ in Figure 1) originated from the left renal artery, dorsal to the origin of the branch, labeled as ‘1’ in Figure 1. The branch ‘1’ in Figure 1, further divided into two branches; a branch to the supra renal gland (‘a’ in Figure 1) and another branch (‘b’ in Figure 1), which further subdivided into two branches (‘b1’ and ‘b2’ in Figure 1). The branch from the renal artery (‘2’ in Figure 1) ascended posterior to ‘1’ in Figure 1 and also subdivided into two branches: a branch to suprarenal gland (‘2s’ in Figure 1) and another branch to the anterior surface of the right kidney (‘2k’ in Figure 1).

The right renal artery (‘RRA’ in Figure 2) originated from the abdominal aorta, slightly inferior to the left renal artery and divided into two branches (‘a’ and ‘b’ in Figure 2) extra-renally. The upper branch (‘a’ in Figure 2) ascended obliquely towards the upper pole of the kidney and just before entering the upper pole further subdivided into two branches, one of which supplied the suprarenal gland. The lower branch (‘b’ in Figure 2) reached the hilum by passing posterior to the renal pelvis. No other associated abnormalities were observed.

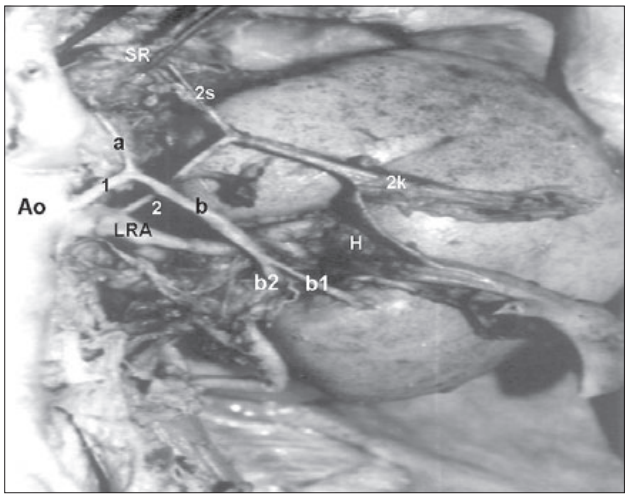


**Fig. 1. Photograph of dissected left kidney (anterior surface) showing. Ao – aorta, LRA – left renal artery, 1 & 2 – two branches from renal artery, SR – suprarenal gland, a – branch to suprarenal gland, H – hilum, b1 & b2 – branches from second branch b, 2s – branch to suprarenal gland, 2k – branch to anterior surface of kidney.**

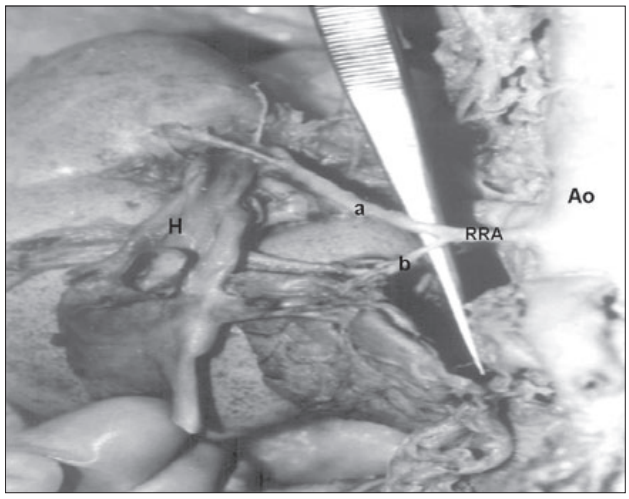


**Fig. 2. Photograph of dissected right kidney (anterior surface) showing. Ao – aorta, RRA – renal artery, a & b – two branches from right renal artery, H – hilum.**

## Discussion

The renal arteries originate from the abdominal aorta and account for 20 % for the cardiac output to the kidneys (1). The sequential subdivisions of the renal artery while entering the kidney from outside are: segmental, lobar, interlobar and arcuate arteries (1). In the present case, we observed an anomalous pattern of the renal arteries. The main renal artery may have otherwise normally divided on reaching the pyramid of the kidney.

The right renal artery is usually at higher level than the left and the same was observed in the present case (1). The classical branching pattern of the segmental arteries before reaching the kidney may have immense clinical importance.

The renal vascular segmentation was discovered as early as in 1794 by John Hunter but a detailed account of the same was given later on in 1950‘s by corrosion cast studies (1). There are five defined arterial segments: apical, superior, inferior, middle and the posterior segments and the anatomical knowledge of these segments is important while performing nephrectomies (1). In the present case also, an anomalous pattern of the renal artery was observed, which might be a result of alterations during embryonic development. The anatomical variations of the renal arteries may be linked to developmental changes of lateral splanchnic arteries (2). The segmental arteries giving branches to the suprarenal gland has also been reported in past research studies (1).

The anatomical knowledge of the sequential division of the arteries, especially the renal arteries, may be important for angiographic studies. Often abnormal branching pattern of the segemental arteries may result in erroneous interpretation of angiograms. Precise knowledge of the renal artery and its branching pattern may be useful for surgeons performing for nephrectomies and renal transplantations. Accessory renal arteries which account for 30–35 % of cases, usually enter the upper or lower poles of the kidney and the main clinical significance of such arteries entering the lower pole is that they may obstruct the ureter leading to hydronephrosis (3). Interestingly in the present study, the accessory renal artery passing posterior to the right renal pelvis may be liable to compression. Admittedly, the clinical history of the patient was not available to corroborate this observation.

Previous research studies have outlined the fact that while preparing for living renal donation, vascular reconstruction, renovascular hypertension, or radical nephrectomy, preoperative renal imaging is mandatory (4). The anatomical knowledge of accessory or multiple arteries is essential before performing any transplantation surgeries, where microvascular techniques are employed to reconstruct the renal arteries (5).

Incidence of multiple arteries has been reported to be 20.2 % and 19 % on right and left sides, respectively (6). A past research study had reported the presence of two renal arteries on the right side, originating from the abdominal aorta (7). In the present case also an anomalous branching pattern of the renal arteries was observed which is in agreement with earlier reports of renal artery anomalies, being observed on both sides. In the present case, we observed two suprarenal arteries arising from the renal artery on the left side. In contrast, the right renal artery gave off only one suprarenal artery. This finding deviates from a recent study, where two suprarenal arteries have been reported to originate from the lower right renal artery (7).

Interestingly, the incidence of donor kidneys vascular anomalies ranges from 18 % to 30 % and such kidneys are usually at increased risk of vascular and urological complications (8). The procedure of laparoscopic donor nephrectomy has gained popularity over the years and research studies have clearly spelled out the difficulty in carrying out such procedures in the presence

of multiple renal arteries (9). Even, lymphoceles are reported to be more frequent among grafts with multiple renal arteries as compared to single arteries (10). Intra-operative bleeding and post surgical complications are often observed as a result of presence of multiple arteries. It requires careful suturing by the surgeon while dealing with cases having multiple renal arteries. Often the renal arteries are anastomosed and presence of anomalous accessory or multiple arteries requires proper pre-operative assessment, in order to prevent any inadvertent injury.

## Conclusion

Recently, laparoscopic surgeries and renal transplantations are gaining wide popularity and it is mandatory for each clinician to be aware of the renal arterial anomalies. Considering the increase in incidence of the accessory and multiple renal arteries, the anatomical knowledge of such may be important for academic, surgical as well as radiological procedures and the present study is a humble effort to highlight the same.

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Received April 11, 2007.
Accepted February 10, 2008.