

A STUDY ON BRANCHING PATTERN OF RENAL ARTERIES

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ABSTRACT

Renal artery variations are becoming more important due to the gradual increase in interventional radiological procedures, urological and vascular operations, and renal transplantation. In the present study out of 80 kidneys 40(50%) kidneys showed the presence of additional renal arteries. The results are statistically significant. The presence of additional renal arteries was found unilaterally in 14 cadavers and bilaterally in 6 cadavers. In 10 kidneys additional artery towards the superior pole (Superior polar artery) was observed and in 10 kidneys inferior polar arteries were seen. And superior and inferior polar arteries both are present in 20 kidney specimens. In 40 kidney specimens we were found duplicated renal arteries. This multiple renal artery variations are of great clinical significance to radiologists, nephrologists and urologists in imaging and urological procedures.

KEYWORDS: Renal artery; Superior polar artery; Inferior polar artery.

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INTRODUCTION

The kidneys are one of the vital organs in the human body. It receives rich blood supply, nearly 25% of the cardiac output pass through the renal arteries to be filtered by the kidneys. These are end arteries with no anastomosis. Variations in the number and arrangement of the renal vessels are extremely common [1]. The paired renal arteries arise from the aorta just below the origin of the superior mesenteric artery and takes 20% of cardiac output. 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. Classically, a single renal artery supplies each kidney. Variations in the number and arrangement of the renal vessels are extremely common. The so called aberrant or accessory arteries were in fact, normal segmental arteries.

As the invasive interventions such as renal transplantation, interventional radiologic procedures and urologic operations increase, awareness of the possible variations of the renal arteries is necessary for adequate surgical management in the aforementioned specialties [2]. 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. The advent of more conservative methods in renal surgery has necessitated a more precise knowledge of renal vascularisation and its importance in partial and total renal transplantation surgeries[3]. The objectives of present study are to study the origin, course of renal arteries and to study the aberrant and accessory renal arteries.

MATERIALS AND METHODS

A total 40 formalin fixed cadavers irrespective of sex of cadavers constituted the material for the study, during routine abdominal dissection conducted for medical undergraduates of SS Institute of Medical Sciences and Research Centre, Davangere. The kidneys and their arteries were explored and variations in morphological patterns of renal arteries were noted. During the course of dissection, various abdominal viscera were removed and preserved as specimens for teaching purposes. Renal veins were also reflected for proper visualization of segmental patterns of renal arteries.

Variations of renal artery:

Renal artery variations including their number, source and course are very common. Irregularities the most common being an additional or accessory artery arising above or below the usual renal artery and entering in to upper pole or lower pole named as superior and inferior polar artery respectively. And the artery other than the main renal artery was entering in to the hilum named as a duplicated renal artery [4]. During development, the kidneys initially lie in the pelvic cavity. As the embryo grows they ascend to reach the lumbar region. When they are present in the pelvic cavity, they take their blood supplies from branches of iliac arteries, and as they ascend their blood supplies also shift from the iliac arteries to the abdominal aorta [5]. Presence of abnormal number, site and accessory (superior polar & inferior polar artery) arteries are due to the persistence of embryonic vessels which are formed during the ascent of the kidney. It is essential for surgeons to bear in mind the possibility of such additional superior polar arteries before performing any transplantation surgeries, as kidney transplantation with multiple renal arteries has a chance of rejection, tubular necrosis, or poor graft function [6].

OBSERVATIONS

Specimen No. 1:



Specimen No. 1: Superior polar artery present in left kidney along with normal renal artery.

Specimen No. 2:



Specimen No. 2: Inferior polar arteries are present in both kidneys.

Specimen No. 3:



Specimen No. 3: Duplicated renal arteries are present.

RESULTS AND DISCUSSION

In present study (Figure 1) out of 80 kidney specimens in 10(12.5%) kidneys we observed superior polar artery which is the branch of abdominal aorta. A branch originating directly from the renal artery (superior renal polar branch) was observed on the right hand side in 26 kidneys (17.2%) and in 19 on the left-hand side (13.5%) (Saldarriaga et al., 2008) [7]. Sampaio et al., [8] 1992 observed superior polar artery origin from the aorta in 6.8% of kidneys. Bordei et al., 2007 reported that in 5 out of 54 cases (9.25%) the supplementary renal artery entered the kidney through the superior pole.

Budhiraja et al., [9] 2008 observed that 10.7% of cases the superior polar artery originated directly from the abdominal aorta as an additional renal artery. The present study is slightly higher than the above mentioned data.

In present study out of 80 kidney specimens 10(12.5%) kidney specimens inferior polar artery was arising from the abdominal aorta (figure 2) and in one case it was arising from the renal artery. The vessel originated from the aorta below the level of the corresponding renal vein (Hilel Nathan et al., [5] 1958; Janschek et al., [6] 2004) was found inferior polar artery in 16 cases.

In present study (figure 3) out of 80 kidney specimens in 40(50%) kidney specimens duplicated renal artery was arising from the abdominal aorta. Bordei et al., (2004) studied renal vascularisation and reported 54 cases of double renal arteries supplying one kidney and originating from aorta. Of the 54 cases, six cases were bilateral. In about 28 cases, supplementary renal artery entered the kidney through the hilum. Incidence of multiple arteries has been reported to be 20.2% and 19% on right and left sides, respectively by Janschek et al., [6] 2004. However Saldarriaga et al., [7] (2008) reported 97(24.9%) out of 390 kidneys having additional arteries; 87 (22.3%) had one additional artery and 10 (2.6%) had two additional arteries. It is suggestive of higher incidence of presence of double renal arteries.

CONCLUSION

Here in the present study we observed the presence of superior and inferior renal polar artery in 12.5% of cases respectively and both were present simultaneously in 25% of cases. In most of the cases they were arising from the abdominal aorta except in one case inferior renal polar artery was arising from the renal artery. Duplicated renal arteries were observed in 50% of cases and arising from abdominal aorta. This high incidence of presence of additional renal arteries are significant in the invasive interventions such as renal transplantation, interventional radiologic procedures and urologic operations, renal artery embolization, angioplasty or vascular reconstruction for congenital and acquired lesions. Polar or multiple renal arteries to a normally positioned

kidney represents a failure of complete regression of all primary vascular channels. These multiple arteries may constrict infundibulum, major calyx or uretero pelvic junction. These arteries may pose altered haemo dynamics in renal physiology. The evaluation of renal angiograms will be difficult unless you know these anatomical variations. More over renal arteries are functional end arteries, the ligation of which may lead to degeneration of that segment of kidney. These multiple arteries complicate the kidney transplantation surgeries and may cause post operative bleeding. The urologist must preserve each multiple arteries to save the renal segment since they are end arteries. So prior to surgical intervention renal angiogram is mandatory.

Conflicts of Interests: None

REFERENCES

- [1]. Bordei P, Sapte E, Iliescu D and Dina C. The morphology and the surgical importance of the gonadal arteries originating from renal artery, *Surgical and Radiologic Anatomy* 2007; 29(5): 367–371.
- [2]. Gupta V, Kotgirwar S, Trivedi S, Deopujari R and Singh V. Bilateral variation in renal vasculature. *International Journal of Anatomical Variations* 2010; 3:53–55.
- [3]. Hamilton WJ and Mossman HW (1979). In: *Human embryology*. Mc Millan Press, New York, 4 392.
- [4]. Harrison LH, Flye MW and Seigler HF. Incidence of anatomical variants in renal vasculature in the presence of normal renal function. *Annals of Surgery* 1978;188:83–89.
- [5]. Hilel Nathan MD. Observations on Aberrant Renal Arteries Curving Around and Compressing the Renal Vein Possible Relationship to Orthostatic Proteinuria and to Orthostatic Hypertension. *Journal of the American Heart Association* 1958;18:1131-1134.
- [6]. Janschek EC, Rothe AU, Holzenbein TJ, Langer F, Brugger PC and Pokorny H et al., Anatomic basis of right renal vein extension for cadaveric kidney transplantation. *Journal of Urology* 2004;63: 660-4.
- [7]. Saldarriaga B, Pinto SA and Ballesteros LE. Morphological expression of the renal artery. A direct anatomical study in a Colombian half-caste population *International Journal of Morphological Sciences* 2008;26(1):31-38.
- [8]. Sampaio FJ and Passos MA. Renal arteries: anatomic study for surgical and radiological practice. *Surgical and Radiologic Anatomy* 1992;4:113–117.
- [9]. Budhiraja V, Rastogi R & Asthana AK. Variant origin of superior polar artery and unusual hilar branching pattern of renal artery with clinical correlation, *India Folia Morphology* 2008;70(1):24–28.