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RENAL ARTERY : VARIATIONS AND IT'S CLINICAL SIGNIFICANCE

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ABSTRACT

Anatomy of renal artery and its variations is well known in literature. Anatomical variations in renal vessels have significant importance in diagnostic and therapeutic procedures. Knowledge of Accessory or aberrant renal artery is important for performing endovascular, radiological, laparoscopic procedures and surgical interventions in transplants, nephrectomies and renal vascular disorders. The present study was conducted in department of anatomy Govt. medical college Patiala, India during routine abdominal dissection for medical undergraduate students. Kidneys along with its arteries were exposed in 13 cadavers (12 males and 1 female). Variation in the form of accessory renal artery was found in two cadavers. Knowledge of variations in renal vasculature is important for clinicians uroradiological procedures and renal surgeries.

Keywords : Kidney, accessory renal artery, cadavers , variation.

INTRODUCTION

The Kidneys are vital excretory organs present behind the peritoneum over the posterior abdominal wall. They receive 20% of resting cardiac output. In 70% population, kidney is supplied by one renal artery[1]. Renal artery is lateral branch of aorta, arising at the level of second lumbar vertebra. On right side, it passes behind the inferior vena cava and thereafter, right renal vein. Whereas, on left side it usually lies behind and above the left renal vein, behind the pancreas and splenic vein. Variations in the number and arrangement of renal vessels are extremely common. Anomalous renal arteries are consistently encountered than anomalous renal veins[2]. The commonest type being the supernumerary renal artery, derived from the aorta or its abdominal or pelvic branches. Out of these arteries about half went to either pole of the kidney[3]. The accessory renal arteries supply the kidney without entering its hilum[4]. These unrecognised extra hilar, polar arteries impose surgical hazards. Also these arteries to the lower pole typically pass in front of the ureter, causing obstruction in pelviureteric region leading to hydronephrosis and other obstructive symptoms requiring surgical intervention[5]. The left sided lower pole aberrant artery has also been noted to compress the internal spermatic vein leading to left varicocele [2].

The knowledge of presence of these extra hilar accessory renal arteries guides the surgeons while dissecting the renal capsule during renal transplants or other conservative renal surgeries and therapeutic procedures. Therefore, this study imparts clinical and surgical insight to surgeons, urologists and interventional radiologists.

MATERIAL METHOD

26 kidneys of 13 cadavers comprising of 12 males and 1 female were examined after routine cadaveric dissection for the purpose of under graduate teaching in Department of Anatomy Govt. Medical College, Patiala . After removal of the other abdominal viscera, both the kidneys with their renal arteries were exposed to study any morphological variations.

RESULTS:

The study was undertaken on 13 cadavers, out of which 12 were males and 1 female. Amongst them,

two (15.38%) cadavers were found to have variations in renal arteries. In 11 (84.61%) cadavers a normal single renal artery pattern was observed. The supernumerary, accessory renal arteries were seen unilaterally, in 2 male cadavers.

The following pattern of variations were noted in these renal arteries.

1. In one cadaver unilateral accessory renal artery was seen arising from left renal artery. It followed an extra hilar course to enter into superior pole of kidney (Figure 1).

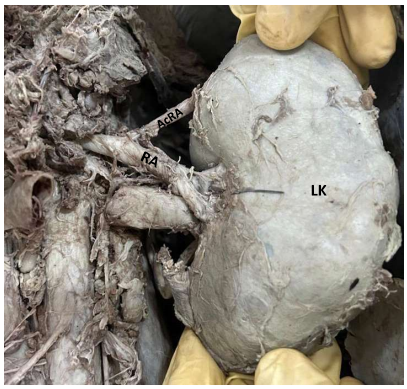


Figure 1. Accessory renal artery arising from Left Renal artery (LK; Left Kidney; AA; Abdominal Aorta; RA: Renal artery; AcRA: Accessory Renal artery)

2. In the other cadaver accessory or aberrant renal artery was seen on the right side, originating as a direct branch of abdominal aorta. It crossed the right ureter anteriorly to reach the inferior pole of kidney(figure 2).

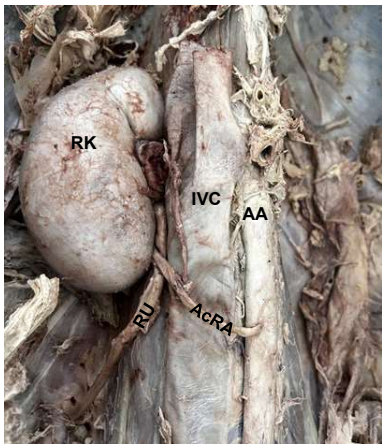


Figure 2. Accessory renal artery originating from abdominal aorta crossing right ureter (RK: Right Kidney; IVC: Inferior Vena Cava; AA; Abdominal Aorta; AcRA: Accessory renal artery)

DISCUSSION :

It is very common to find Anatomical variations in renal vasculature ,i e for about 30% [4]. These have been named as accessory or aberrant arteries. Accessory arteries originate directly from aorta either above or below the renal artery and enter the upper or lower pole of kidney [6].

The development of kidney and its vessels is complex. The prevalence of these arteries can be interpreted on embryological basis. The multiple renal arteries are vestigial remnants due to the failure of degeneration during the ascent of metanephros lying in the pelvis. In the developing fetus, the mesonephros and metanephros are supplied by nine pairs of branches of dorsal aorta namely lateral mesonephric arteries(MNA). These nine pairs are distributed into 3 groups – Cranial(first and second MNA), Middle (third to the fifth)and Caudal group (sixth to the ninth) of arteries. The renal artery develops from single pair from the middle group. The remaining arteries of the middle group have seen to result in aberrant renal arteries [7,8]. The multiple renal arteries supply a separate part of kidney and do not anastomose within kidney parenchyma. Hence, obstruction of any of these can lead to ischemic necrosis of that part [9].

In present study, accessory renal artery noted on the right side, given off directly by aorta crossed the right ureter to pierce the lower pole of right kidney. The incidence of accessory renal arteries to the inferior pole is more as compared to those passing to the superior pole. These extra renal arteries follow an anomalous course up to the lower pole, lie in such a position as to appear to obstruct the outflow of urine at pelviureteric junction leading to hydronephrosis [10].

The inferior polar arteries are seen to be more in diameter as they are derived directly from aorta. Such large calibre vessels crossing the ureter can cause compression leading to hydronephrosis 11.

Another artery originating from left renal artery was observed. It followed an extra hilar course to enter the superior pole of the kidney. This type of variant can be considered as a divisional branch from the early branching renal artery. The persons having similar early branching renal arteries are not considered suitable donors for transplants due to

smaller renal pedicle size[12].

Accessory renal arteries were noted in male cadavers in the current study. This could be attributed to smaller sample size available. However, a higher prevalence of variations is noted in males [9,13]. The awareness of increased incidence in males is worth noting clinically because , males are more affected by end stage renal failure therefore, prone to undergo renal transplants [14].

The classical bilateral renal artery remains the most common, favourable and preferred configuration for donor nephrectomy and transplant[15]. The transplantation of such kidneys is easier and has successful outcome as compared to kidneys with multiple/ supernumerary arteries. Atypical vascular pattern of renal pedicle can lead to haemorrhage and complications during anastomosis and reperfusion [11].

It is thus concluded, the knowledge and identification of variable renal vascular pattern can help transplant surgeons and interventionists to plan ahead and prevent major complications leading to improving surgical outcome.

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