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Case Study

CADAVERIC STUDY OF ACCESSORY DOUBLE HILAR ARTERIES: A VARIATION OF RENAL ARTERY

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ABSTRACT

The growing number of renal transplants and other uro-radiological procedures has increased the importance of having a thorough understanding of the variations in the renal arteries. Accessory renal arteries (ARAs) are kind of renal artery variations estimated to be present in 15% to 25% of the population. The renal arteries are the sole vascular supply to the kidneys, and they originate from the lateral aspect of the abdominal aorta, usually at the level of L1/L2 intervertebral disk, just below the superior mesenteric artery. Variations in renal arteries can be seen in their origin, number, and course. The most common is the presence of additional vessels (accessory arteries) that arise from abdominal aorta. During our routine dissection, accessory renal arteries were found on both the side supplying to both kidneys. And also, we observed that these accessory renal arteries were entering kidneys through the hilum region so called accessory double hilar arteries. Knowledge of renal artery variations during renal transplantation, partial nephrectomy, laparoscopic surgery and angiographic interpretation by radiologists is very important for urologists.

INTRODUCTION

The kidneys are retroperitoneal organs typically supplied by the right and left renal arteries, which are branches of the abdominal aorta located just below the origin of the superior mesenteric artery. About 20 to 25% of cardiac output is delivered to kidneys by these renal arteries. Accessory renal arteries are additional to single renal artery. These accessory renal arteries commonly arise from the abdominal aorta inferior to the normal level of origin of renal artery but it may also arise from the phrenic, superior mesenteric, inferior mesenteric and common iliac artery. The variations of renal artery are common in their number, positions and course[1,2]. The presence of an accessory renal artery was reported in approximately 30% of cases by many researchers [3-5] and this presence of accessory renal arteries is found associated with high failure rate and post-operative complications in renal transplantation [4]. According to other research study it is observed that by dissection of 36 cadaver, accessory renal arteries in 30.56% of cases with unilateral incidence in 27.78% and bilateral in 2.67% cases. Accessory hilar renal arteries were observed in 16.68% and accessory polar renal arteries in 13.89% cases. Accessory arteries were more common on left (16.68%) than on the right side (11.12%). Inferior polar arteries were more common than superior polar arteries [6]. It is important to be aware that accessory renal arteries act as end arteries; therefore, if an accessory renal artery is ligated in the donor kidney and not vascularized subsequently, the part of the kidney supplied by it is likely to become ischemic [3]. Knowledge of the variations of the renal artery has grown in importance with increasing numbers of renal transplants, vascular reconstructions and various surgical and radiologic techniques being performed in recent years; as well as during nephrectomy and segmental resection [7].

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METHODS

A case of accessory renal artery was identified during routine dissection of posterior abdominal wall of cadavers for undergraduate scholars. This dissection was performed on the male cadaver of 72 years old in the department of Rachana Sharir, National institute of Ayurveda (Deemed university) Jaipur, Rajasthan, India.

During the routine dissection; we have identified two accessory renal arteries [Fig 1]. While performing the dissection of posterior abdominal wall on male cadaver aged 72 years through the approach of grants dissector, bilaterally two renal arteries i.e. accessory double hilar arteries for each kidney were located. These arteries were arising from abdominal aorta just below the origin of superior mesenteric artery. The accessory renal arteries that we identified are the accessory hilar arteries they entered the kidney through the hilum region [Fig 2]. On the right side accessory double hilar arteries i.e. right superior hilar artery and right inferior hilar artery were identified. It is observed that the right superior hilar artery was giving two segmental branches to right kidney one to the apical segment and other one to the upper anterior segment. It was also giving one branch to corresponding suprarenal gland. The right inferior hilar artery was giving three segmental branches i.e. middle anterior, lower and posterior segment of right kidney [Fig 3].

Further, similarly on left side we observed that accessory double hilar arteries i.e. left superior hilar artery and left inferior hilar artery were identified. Here it is observed that the left superior hilar artery was giving only one segmental branch i.e. to the apical segment of left kidney no any branches to corresponding to suprarenal gland.

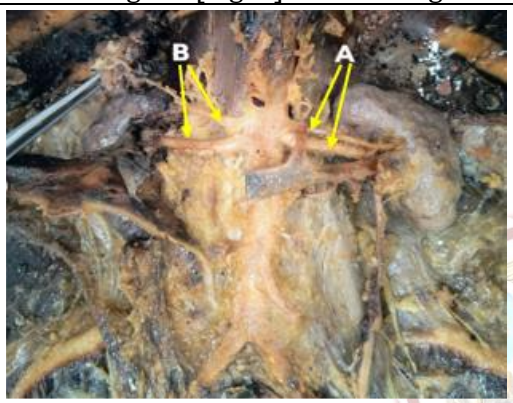

Fig 1: Bilateral accessory renal arteries (bilateral Accessory double hilar arteries) A) Left superior and inferior accessory hilar arteries B) Right superior and inferior accessory hilar arteries

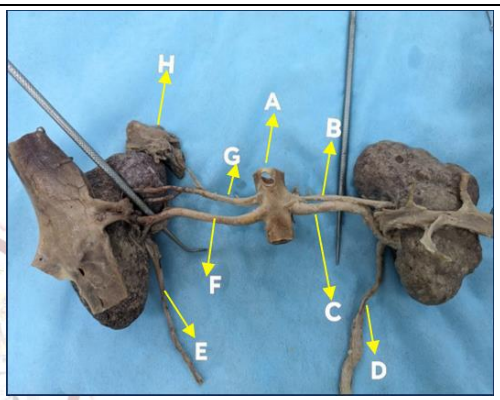

Fig 2: Bilateral accessory double hilar arteries. A) Abdominal aorta B) Lt superior hilar artery C) Lt inferior hilar artery D) Lt ureter E) Rt ureter F) Rt superior hilar artery G) Rt inferior hilar artery H) Suprarenal gland

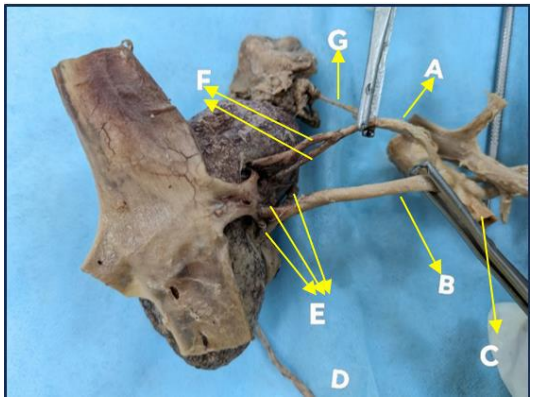

Fig 3: Segmental branches to Right kidney. A) Rt superior hilar artery B) Rt inferior hilar artery C) Abdominal aorta D) Rt Ureter E) Rt inferior hilar artery giving 3 segmental branches F) Rt superior hilar artery giving 2 segmental branches and G) 1 branch to suprarenal gland

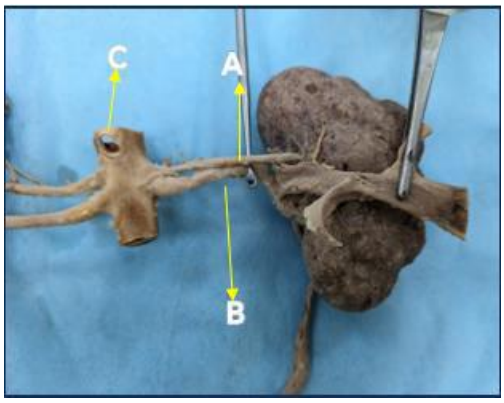

Fig 4: Branches of left kidney. A) Left superior hilar artery giving one segmental branches B) Left inferior hilar artery giving 4 segmental branches C) Superior mesenteric artery

The left inferior hilar artery was giving four segmental branches i.e. upper anterior, middle anterior, lower and posterior segment to left kidney [Fig 4].

Upon comparison of both the right and left side accessory arteries, the superior accessory hilar artery is smaller in diameter compared to the inferior accessory hilar artery.

DISCUSSION

Embryological explanation of these variations has been presented and discussed by Felix (1912) in an 18mm foetus[8]. The developing mesonephros, metanephros, suprarenal glands and gonads are supplied by nine pairs of lateral mesonephric arteries arising from the dorsal aorta. Felix divided these arteries into three groups. The 1st and 2nd arteries as the cranial, the 3rd to 5th arteries as the middle, and the 6th to 9th arteries as the caudal group. The middle group gives rise to the renal arteries. Persistence of more than one artery of the middle group results as multiple renal arteries. Initially the metanephric kidney lies in the sacral region and subsequently with the differential growth of the abdominal wall, it ascends via the iliac fossa to its final destination in the lumbar region. The caudal arteries degenerate and one of the more proximal vessels which are closer to the final position of the kidney persist as a single renal artery on either side [9].

The failure of regression of these arteries results in accessory renal arteries. Thus, the multiple renal arteries in our study may be a result of persisting lateral mesonephric arteries from the middle group. The various types of accessory renal arteries, their number, position and the way of entry into the kidney and its segmentation were studied extensively [2]. Bordei et al. (2004) reported 54 cases of double renal artery supplying one kidney. Out of 54 cases, 6 cases were bilateral[10]. Accessory arteries to the inferior pole, running anterior to the renal pelvis or ureter may be the cause of hydronephrosis due to the obstruction to the flow of urine at pelvic-ureteric junction or the proximal part of the ureter. Reported incidence of inferior polar arteries is 15.1% and that of superior polar arteries 9.6% cases [11-13].

The incidence of bilateral accessory renal arteries has been ranging from 1.66% to 10%. Studies of Dhar and Lal (2005), reported bilateral accessory renal arteries in 5% cases [14]. The presence of bilateral accessory renal arteries makes it technically difficult to procure the donor kidney for transplantation and also, they result in increased incidence of subsequent complications.

Different studies showed that left side shows more variations than right. In our study we found both right and left accessory renal arteries.

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CONCLUSION

The renal artery common variation i.e. accessory renal arteries were studied. Knowledge and understanding of anatomical variation play great role in clinical practice. Although variations in genetics and physiology may not directly harm the body's physiology, their involvement in disease manifestation can be of significant importance. Thus, a uro surgeon needs to be aware of the detailed knowledge of the variations of renal artery of the donor as well as of the recipient during renal transplantation. Surgeons must be prepared to adopt techniques and approaches to accommodate these variations to ensure the best possible outcomes for their patients. Knowledge of variations does appear mandatory during nephrectomy, laparoscopic surgery and angiographic interpretations by radiologists.

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