



Case Study

BILATERAL ACCESSORY RENAL ARTERIES: A CADAVERIC CASE STUDY

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ABSTRACT

Variations in the renal arteries are among the most clinically significant anatomical variations of the renal vascular system and have important implications for surgical and radiological procedures. Accurate knowledge of these variations is essential for renal transplantation, partial nephrectomy, laparoscopic surgery, and angiographic interventions. During our routine cadaveric dissection, a rare bilateral variation was observed in which both the right and left kidneys were supplied by three separate renal arteries arising from the abdominal aorta. This finding is uncommon, as single or double renal arteries are more frequently observed. Such vascular variations are attributed to the persistence of embryonic vessels during renal development. Since the renal arteries provide the sole arterial blood supply to the kidneys, failure to identify these accessory vessels before surgery may increase the risk of bleeding, renal ischemia, and other operative complications. A thorough understanding of these anatomical variations, along with careful preoperative vascular evaluation, can assist surgeons, urologists, and radiologists in planning safer procedures and improving clinical outcomes. This case emphasizes the importance of recognizing and documenting rare renal arterial variations to enhance anatomical knowledge and support better patient care.

INTRODUCTION

The kidneys are paired retroperitoneal organs with a rich vascular supply that is essential for their normal function. Under normal anatomical conditions, each kidney is supplied by a single renal artery that originates from the lateral side of the abdominal aorta, typically inferior to the superior mesenteric artery, and is drained by a corresponding renal vein, but additional arteries may also be present. These are known as accessory renal arteries. The kidneys receive about 20–25% of the total cardiac output through the renal arteries. Most accessory renal arteries originate from the abdominal aorta below the main renal artery, although they may also arise from other vessels such as the inferior phrenic, superior mesenteric, inferior mesenteric, or common iliac arteries. It is termed an accessory hilar renal artery, if an extra artery enters

through the renal hilum, whereas one entering directly at the upper or lower pole is called an accessory polar renal artery. Variations in the renal arteries are frequently observed, involving differences in their number, origin, and course. [1-2]

Studies have shown that accessory renal arteries are present in approximately 30% of the population. [3-5] Their presence is clinically important because they can increase the complexity of renal transplantation and may contribute to surgical complications. [4]

According to other research study, it is observed that by dissection of 25 cadavers, renal arterial variations reported in 25% of the cases. Among the observed variations, bilateral incidence in 8.3% of cadavers, while unilateral in 16.7%. Accessory renal arteries were observed in 12.5%. When analysed according to side, variations were more common on the right (20.8%) than on the left (12.5%). [6]

Since accessory renal arteries function as end arteries, interruption or failure to preserve these vessels during surgery may compromise blood supply to the corresponding renal segment, resulting in ischemia. [3]

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A thorough understanding of renal arterial variations is essential for planning renal surgeries and interventional procedures. It helps reduce surgical complications, improves the success of renal transplantation and partial nephrectomy, and supports accurate interpretation of angiographic findings.^[3]

METHODS

A rare anomaly of the vessels supplying the kidney of 78-year-old male cadaver was found during a routine dissection of posterior abdominal wall for PG Scholars in the Department of Rachana Sharir, National Institute of Ayurveda (Deemed University) Jaipur, Rajasthan, India.

During routine anatomical dissection of the posterior abdominal wall in a 78-year-old male cadaver using Grant's dissection approach, bilateral accessory renal arteries were observed [Fig. 1]. Each kidney was supplied by three accessory renal arteries, consisting of one main renal artery and two accessory renal arteries.

The right side of kidney, received three renal arteries i.e., one main and two accessory arteries originating from the aorta. Among them, one is

superior to the main renal artery but inferior to the superior mesentery artery and the other one is inferior to the main artery as well as inferior mesentery artery [Fig 2]. It is observed that the right superior accessory renal artery divided into three branches, of which one supplied the upper pole of the kidney and the remaining two entered the renal hilum. It was also giving one branch to the corresponding suprarenal gland. The right inferior accessory renal artery entered the renal hilum. [Fig 3] Further, similarly the left kidney had three arteries i.e., one main and two accessory arteries originating from the aorta. Among these, one accessory renal artery arose at the same level as the main renal artery, whereas the other originated inferior to the main renal artery. The left superior accessory renal artery traversed the left renal vein and then entered the renal hilum, while the inferior accessory renal artery supplied the lower pole of the kidney as an accessory polar artery. [Fig 4]

Upon Comparison of the bilateral accessory renal arteries revealed that the left-sided accessory renal arteries had a smaller diameter than the right-sided accessory renal arteries.



Fig. 1: Bilateral accessory renal arteries A) Right superior and inferior accessory renal artery B) Left superior and inferior accessory renal artery

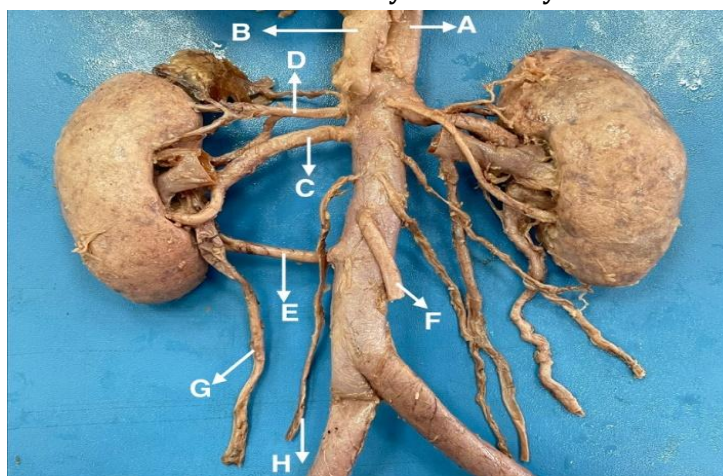


Fig. 2: A) Abdominal aorta B) Superior mesenteric artery C) Right renal artery D) Right superior accessory renal artery E) Right inferior accessory renal artery F) Inferior mesenteric artery G) Right ureter H) Right gonadal artery

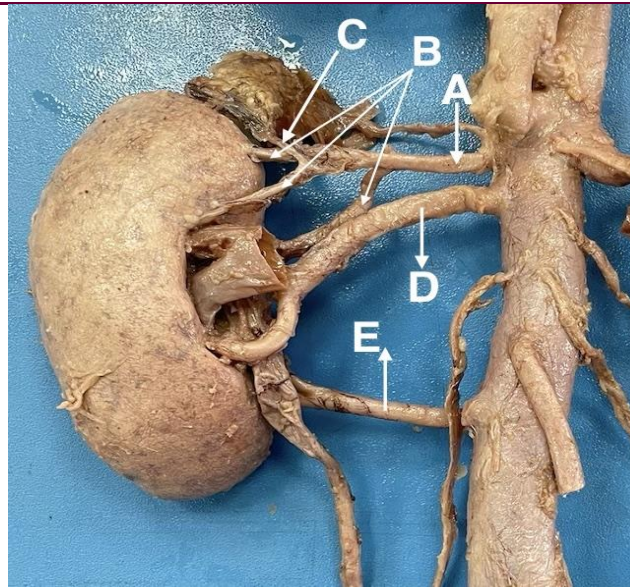


Fig. 3: A) Right superior accessory renal artery B) 3 branches of Right superior accessory renal C) 1 branch to suprarenal gland D) Right renal artery E) Right inferior accessory renal artery

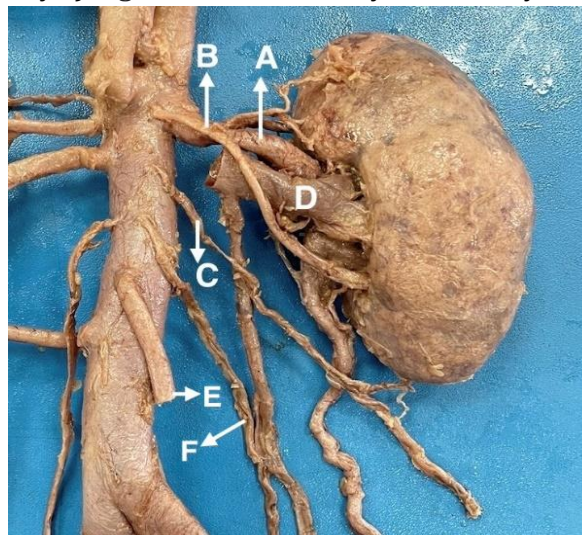


Fig. 4: A) Left renal artery B) left superior accessory renal artery C) left inferior accessory renal artery D) left renal vein E) Inferior mesenteric artery F) left gonadal artery

DISCUSSION

Embryological explanation of these variations has been presented and discussed by Felix (1912) in an 18mm foetus [7].

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 [8].

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.[1]

Bordei et al. (2004) reported 54 cases of double renal artery supplying one kidney. Out of 54 cases, 6 cases were bilateral. [9]

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.^[10-12]

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 ^[13].

Bilateral accessory renal arteries can make donor kidney retrieval during transplantation more difficult and may increase the risk of complications. Several studies have reported that renal arterial variations are more common on the left side than on the right. In our study, accessory renal arteries were observed on both the right and left sides.

CONCLUSION

Accessory renal arteries are a common anatomical variation and should be identified before renal surgeries and transplantation. Damage to these arteries may compromise the blood supply to the corresponding part of the kidney. Therefore, a clear understanding of renal arterial variations is important for surgeons and radiologists to ensure proper surgical planning, accurate interpretation of imaging, and to reduce the risk of complications during procedures such as renal transplantation, nephrectomy, and laparoscopic surgery.

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