

Accessory Renal Arteries: A Cadaveric Study

T. Sumalatha¹, N. Pushpamala²

Abstract

Introduction: Each kidney is supplied by a single renal artery originating from abdominal aorta at the level of L1 vertebra. Accessory renal arteries are common, they derive from the persistence of embryonic vessels formed during ascent of the kidney. We present, bilateral double renal vessels and unilateral accessory renal arteries discovered during a routine dissection of abdomen at department of Anatomy, Osmania medical college, during 2014-2018. **Materials and Methods:** Case1- We found 2 renal arteries running parallel to each other towards the hilum of the right kidney, both are derived from abdominal aorta. Case 2 -Accessory renal artery originating from main renal artery entering the lower pole of the left kidney crossing superficial to hilar structures. Case 3- There is a crossing of the left renal artery over the renal vein disrupting the order of hilar structures. Case 4- Left Accessory renal artery arising from abdominal aorta below the renal artery supplying the lower pole of the kidney superficial to renal vein. Case 5- Left accessory renal artery arising from abdominal aorta, supplying the lower pole of the kidney passing below the renal vein. Case 6- Arterial trunk originating from right renal artery and supplying the suprarenal gland and diaphragm. **Conclusions:** The study was carried out among 60 cadavers and we found the variations in 14 cadavers. The incidence of the anomalies is 23.3%. Awareness of the variations of the renal artery is necessary for surgical management during renal transplantation, repair of abdominal aorta aneurysm, urological procedures and angiographic interventions.

Keywords: Accessory Renal Artery; Aberrant Renal Artery; Kidney.

Introduction

Each kidney is usually supplied by one renal artery which arises from the abdominal aorta. Near the hilum of the kidney, renal artery divides into anterior and posterior divisions and they further divide into segmental arteries supplying the respective vascular segments of the kidney in 70% of individuals [1].

Accessory renal arteries are common in 30% of the individuals, they usually arise from the abdominal aorta above or below the renal vessels, they are regarded as persistent embryonic lateral splanchnic arteries [2].

Rarely they may arise from renal artery and run towards the hilum, or from common iliac artery, superior mesenteric artery, or inferior mesenteric artery [3]. Variations in the number, source, branches and course of the renal arteries are very common.

An accessory renal artery is one that is accessory to main artery and accompanies the main artery while entering the kidney at the hilum. Aberrant renal artery is the one that supplies the kidney without entering the hilum [4].

Renal artery variations are divided into two groups, early division and extra renal arteries.

Early division is one where the branching of the main renal arteries into segmental branches occurs more proximally than the renal hilum.

Extra Renal Arteries are divided into hilar or accessory, and polar or aberrant arteries

Hilar or accessory arteries enter the kidney through the hilum, whereas polar arteries enter the kidney from the capsule outside the hilum [5].

Knowledge about the Variations of the renal arteries helps the surgeon in planning the renal

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transplantation, urological procedures and angiographic intervention and repair of abdominal aorta aneurysms. In the present study we present unusual variations of the renal arteries.

Materials and Methods

During routine dissection of abdomen, as a part of undergraduate curriculum, the study was conducted at the department of Anatomy, Osmania medical college, Hyderabad.

The kidneys, along with their arteries were explored in detail, and morphological variations of the renal arteries were noted. During the dissection, various abdominal viscera were removed and preserved as specimens for teaching purposes. 60 Cadavers constituted materials for our study.

We Studied the accessory renal arteries in accordance to the nomenclature of Merklin and Michels [6].

Results

In a female cadaver we noticed that the right kidney is supplied by two renal arteries running parallel to each other towards the hilum of kidney as seen in Fig.1. Both are arising from abdominal aorta below the level of superior mesenteric artery.

In a male cadaver there was a left renal artery variation. The accessory renal artery originated from the main left renal artery and entered the lower pole of kidney, crossing anterior to hilar structures. Inferior suprarenal artery originated from accessory renal artery (inferior polar artery) as seen in Fig. 2.

There is crossing of the left Renal artery over the the renal vein disrupting the order of hilar structures the vein, artery and pelvis from before backwards. We found accessory renal artery arising from left renal artery, passing anterior to left renal vein and supplying the lower pole of the left kidney as seen in Fig. 3 and Fig 4.

Left Accessory renal artery arising from abdominal aorta below the renal artery supplying the lower pole of the left kidney passing superficial to renal artery, as seen in Fig. 5.

Left Accessory renal artery is found arising from left renal artery, supplying the lower pole of the kidney while passing anterior to renal artery.

Arterial branch is seen originating from right renal artery and supplying the suprarenal gland and diaphragm.

In two cases, left sided accessory renal artery is found originating from left renal artery and supplied the lower pole of left kidney.

Bilateral accessory renal arteries are found originating from main renal artery on each side. The accessory renal arteries are found supplying upper

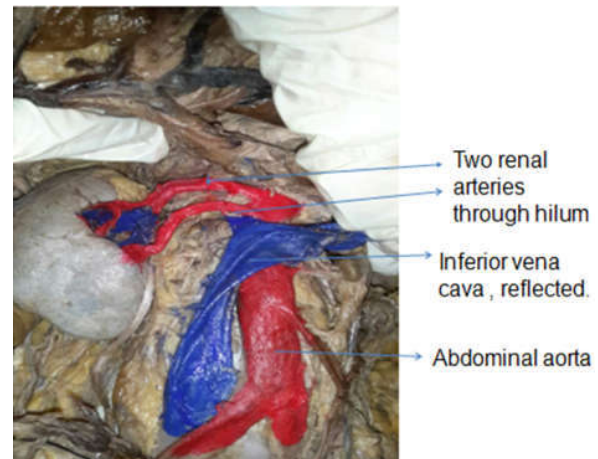


Fig. 1:

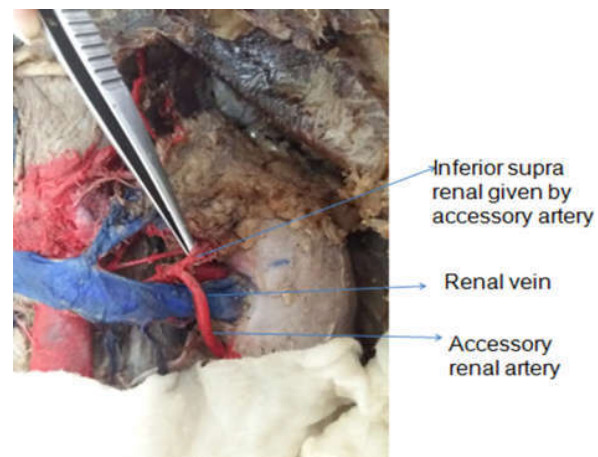


Fig. 2:

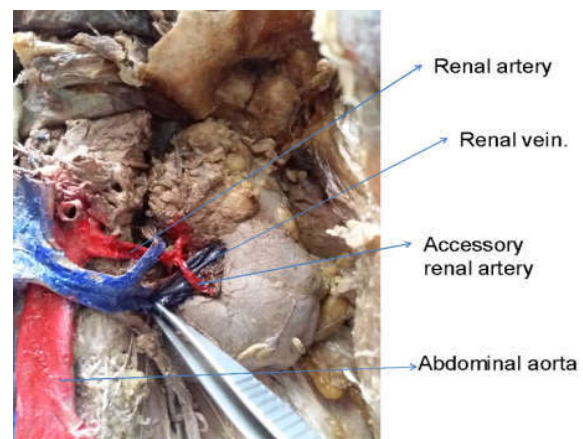


Fig. 3:

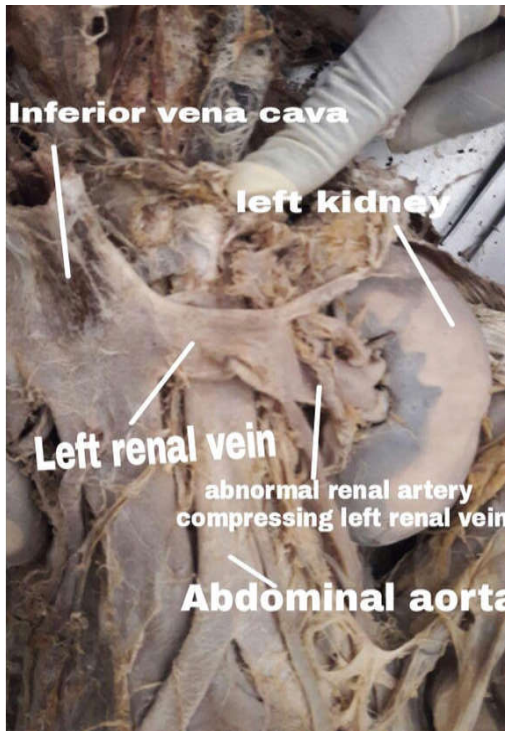


Fig. 4:

and lower poles of respective kidneys. The left renal artery is traced passing in front of the renal vein at the hilum. On the right side, two accessory renal arteries are found arising from main renal artery, supplying both upper and lower poles.

Bilateral accessory renal arteries are seen (a) On the right side, two accessory renal arteries are arising from main renal artery. One accessory artery is found supplying the upper pole and the other accessory artery supplying the lower pole. (b) On the left side, one accessory renal artery is found originating from abdominal aorta supplying the upper pole of the kidney as seen in Figure 6.



Fig. 5:

Bilateral accessory renal arteries originating from abdominal aorta.

Bilateral double renal veins are found and on the left side, superior and inferior polar arteries are seen arising from abdominal aorta as shown in Figure 7.

Discussion

In humans, Metanephric kidney develops in the lumbosacral region. It is retained as a permanent kidney. At first, metanephric kidney lies in the pelvic cavity opposite the sacral segment. It receives blood supply from median sacral artery. Gradually the kidney ascends and reaches the iliac fossa and it is supplied by common iliac and internal iliac arteries. Finally it reaches the under surface of the diaphragm and the ascent is arrested by suprarenal gland⁷

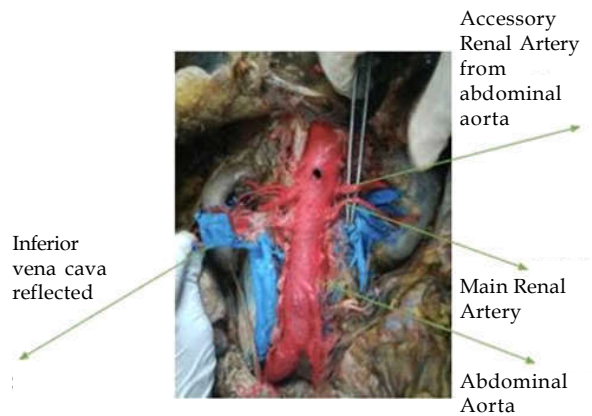


Fig. 6:

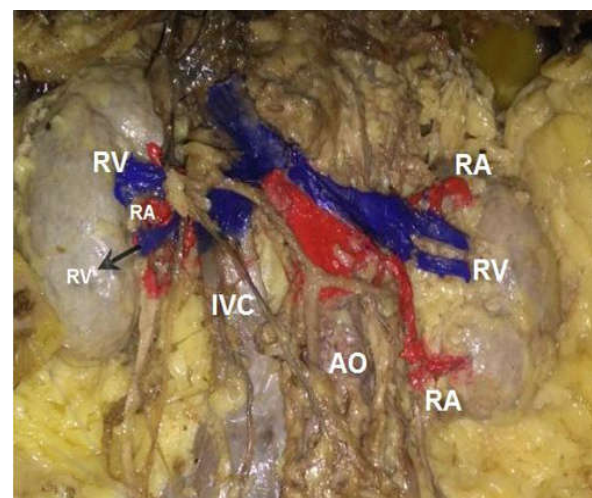


Fig. 7:

Most of the abnormalities of the renal arteries are due to its changing position as a part of normal development [8]. Aberrant renal arteries do not enter the hilum of the kidney, rather they perforate the substance of the kidney [4].

The various types of accessory, additional, supplementary and aberrant renal arteries have been reported but precise terminology has not been unified by majority of authors. Merklin and Michels classified supernumerary renal arteries depending on the origin as those arising from aorta, main renal artery and other arterial sources [6].

Embryological explanation has been given by Felix. In an 18mm fetus, there are 9 pairs of lateral mesonephric arteries arising from dorsal aorta. They are divided into three groups, 1st and 2nd arteries as cranial, 3rd to 5th arteries as middle and 6th to 9th arteries as caudal group. The middle group gives rise to renal arteries. Persistence of more than one artery of the middle group results in multiple renal arteries [8]- According to Talovic et al., in 30.7% of cases supernumerary artery originated from aorta, 12.8% of cases, it originated from renal arteries [9]. In present study, 14 out of 60 cadavers had renal artery anomalies. The incidence is 23.3%. Out of 14 anomalous renal artery, accessory renal artery originated from aorta in (4/60) incidence being 6.6% and accessory renal artery originated from renal artery in (7/60) incidence being 11.6%.

K.S Satyapal in 2001 found that out of 130 renal angiograms and among 32 cadavers included in study, 23.2% had one additional renal artery and seen more commonly on left side (32%) and right side had 23.3% [10]. In present study, right sided accessory renal arteries were seen in (5/60) incidence being 8.3%

Hemanth kommuru et al studied 182 kidneys and found one additional renal artery in 34 kidneys, 2 additional renal arteries in 18 kidneys [11].

Loukas et al found that accessory renal arteries may be associated with other vascular variations [12]. In the present study, accessory renal artery originating from the right renal artery supplied the suprarenal gland and diaphragm.

Satheesha et al found an inferior polar artery on the left side [13]. In the present study there was an inferior polar artery supplying the lower pole on the left kidney. According to Weinstein BB et al., the incidence of incidence of inferior polar accessory arteries is twice to the superior polar artery [14].

Patasi et al found that an Accessory renal artery crossing and compressing the ureter can lead to hydronephrosis [15]. In the present study, accessory

renal artery supplying the lower pole of left kidney was passing superficial to renal vein.

Knowledge of renal vascular anatomy is essential especially in kidney transplantation. Kidney with multiple arteries is associated with more chances of infarction and hemorrhage [16], acute tubular necrosis and rejection episodes [17], postoperative hypertension and calyceal fistula formation.

It has been described that failure to restore circulation in accessory renal artery during surgery, may cause ischemia or necrosis of renal tissue [18].

Conclusions

Knowledge about the variation of the renal arteries is important for renal transplantation, abdominal aortic aneurysms, endoscopic renal surgeries and angiographic interventions. The present study found the incidence of accessory renal arteries as 20%. Therefore considering the increase in incidence of accessory and multiple renal arteries, the anatomical knowledge of such anomalies is important for academic, surgical as well as radiological procedures. The present study attempts to highlight the same.

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