Journal of the Anatomical Society of India 65 (2016) S55–S57

Contents lists available at ScienceDirect

Journal of the Anatomical Society of India

journal homepage: www.elsevier.com/locate/jasi

Original Article

# Accessory renal arteries – Anatomical details with surgical perceptions

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ARTICLE INFO

*Article history:*
Received 21 November 2015
Accepted 13 June 2016
Available online 21 June 2016

*Keywords:*
Accessory renal artery
Variations
Polar artery
Reno-vascular surgery

ABSTRACT

*Introduction:* The accessory renal arteries usually arise from the aorta, above or below the main renal artery and follow it to the renal poles or hilum. With the increasing incidence of renal transplantations and advent of modern imaging techniques in the current era, the knowledge of accessory renal arteries should be well known for preparing renovascular surgical and radiological interventions.
*Materials and methods:* Fifty specimens from 25 adult human embalmed cadavers were taken from the department of anatomy and were studied by dissection method. Morphometric data of the specimens dissected were recorded using Vernier calipers.
*Results:* Accessory renal arteries were noted in 24% of cases with equal incidence on both sides. Most commonly, right and left accessories begin from anterolateral and lateral sides respectively. Within accessory, hilar type was most common (14%), followed by inferior polar in 12%, and superior polar in 2% of specimens. Accessories in 28.5% specimens gave rise to gonadal arteries and 7.3% specimens to inferior suprarenal artery.


## 1. Introduction

The name accessory renal artery is applicable to any artery, other than main renal artery, arising from abdominal aorta to supply the kidney either by passing through its hilum or directly entering its poles.[1] They are not extra but essential vessels to supply the part of the kidney so that injury leads to ischemic necrosis of the parts that they supply.

Anatomical nomenclatures describing the accessory renal artery like-supernumerary, multiple, aberrant, additional, and so on is confusing and controversial.[2,3] Graves suggested the term accessory to an artery arising from the aorta in addition to the main renal artery and aberrant means the renal arteries arising from sources other than the aorta.[4]

Different studies have given different incidences of accessory renal arteries ranging from about 11% to 61%.[1,3] Gross variation in their incidence certainly warrants proper understanding of the accessories and their role in certain clinical conditions.

Accessory renal arteries are generally derived from aorta (25% of all reported cases), or from other sources – inferior mesenteric artery (4%) specimens shows accessory renal artery, iliac, or there may be a co-existence of additional vessels from both sources.[1,5] Such vascular variations may result from the persistence of those embryonic lateral splanchnic vessels.

The knowledge of these accessories, their course, and the branches will help the radiologists and surgeons in avoiding clinical complications during uroradiological interventions and surgical procedures which are related to the abdomen, such as renal and gonadal surgeries.

## 2. Material and methods

Fifty formalin fixed adult human cadaver kidneys belonging to both sexes aged between 30 and 55 years of age were selected. Blood vessels originating from the abdominal aorta to the kidneys (renal and accessory renal arteries) were identified and meticulously delineated. Fascia covering the kidney and suprarenal gland was dissected and removed. It was keenly observed for any variation in the course of accessory renal arteries with relation to inferior vena cava and gonadal veins. Any branches given off by the accessories other than to supply the kidney were noted as well. The length and caliber of the superior polar, hilar, and inferior polar accessory renal arteries were measured by taking a wet thread for accurate measurement. Later, the inferior vena cava was cut 5 cm below and 5 cm above the level of renal veins and removed along with renal and gonadal veins.

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http://dx.doi.org/10.1016/j.jasi.2016.06.003
0003-2778/

**Table 1**
The incidence of different types of accessories found in our study.

| Type of accessory renal artery | Right side | | Left side | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Total no of kidneys with accessory renal artery | 6 | 24 | 6 | 24 | 12 | 24 |
| Total no of accessory renal artery | 7 | 14 | 7 | 14 | 14 | 28 |
| Superior polar accessory | – | – | 1 | 2 | 1 | 2 |
| Hilar accessory | 4 | 8 | 3 | 6 | 7 | 14 |
| Inferior polar accessory | 3 | 6 | 3 | 6 | 6 | 12 |

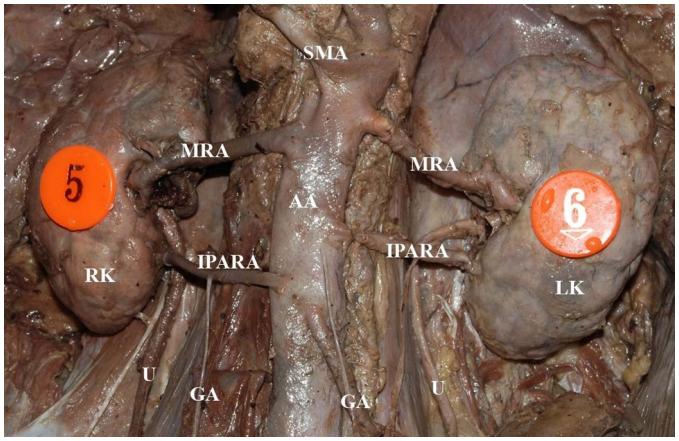


**Fig. 1.** Inferior polar accessory renal artery (IPARA) coursed anterior to inferior vena cava and pelviureteric junction to terminate into inferior pole. Note the right IPARA gave gonadal artery (GA).

## 3. Results

Accessory renal arteries were found in 12 specimens (24%) out of 50 specimens, of which, 2 (4%) specimens showed accessory renal artery on the left side and 10 (20%) specimens showed accessories on both the sides.

The anterolateral side was the most common site of origin of accessory renal arteries with 5 specimens (35.5%) on the right side and 2 specimens (14.5%) on the left side. However, on the left side, most common site of origin was on the lateral side with 4 specimens (29%). The incidence of one accessory (20%) was higher than two accessories (4%). However, there were no significant side differences observed in the incidence of accessories.

Hilar accessory renal artery was the most common of accessory renal artery with their caliber 3–4 mm and length measured between 2 and 7.2 cm. Superior polar accessory renal artery was seen only on the left side in l (2%) specimen, hilar accessory renal arteries on the right side were 4 (8%) in number, and on the left side were 3 (6%) and inferior polar arteries were 3 (6%) on both the sides. Caliber and the length of inferior polar accessory were 2–5 mm and 4.6–6.5 cm respectively.

Out of 14, 5 (37.8%) specimens of accessory renal arteries showed various branches, of which, 4 (28.5%) were gonadal and 1 (7.3%) was inferior suprarenal artery.

Out of 50 kidney specimens, we noticed lobulations in 4 (8%) and none of them showed accessory renal arteries (Table 1).

## 4. Discussion

Existence of accessory renal arteries is the most frequent renal vascular anomaly as noted by earlier authors. The incidence of this anomaly in subjects of Indian origin was found to be 20% with more predilections toward right side (15%).[6–8] The present study (of accessories was 24%) coincides with the findings of Saldarriaga et al., but with equal incidence on both the sides (Fig. 1).[9]

Saldarriaga et al. analyzed the number of accessories and found single accessory renal artery in 22.3% and two in 2.6% of the population, of which, 52.4% of specimens arose from the lateral aspect of the abdominal aorta and entered the kidney through its hilum.[9] Kara et al. found the frequency of single, double, or more accessory renal arteries in 17.6%, 2.3%, and 1% respectively.[10] In contrast, we found 20% of single and 4% of double accessory renal arteries only (Fig. 2).

Among the branches given off by the accessories, most of them give off gonadal (28.5%) and inferior suprarenal artery in one case (7.3%). This infers that most common branches from accessories include gonadal, followed by inferior phrenic, and least common is inferior phrenic. Without proper care, surgical interventions on the kidney would invariably damage the gonadal vessels and hence the gonadal atrophy (Fig. 3).

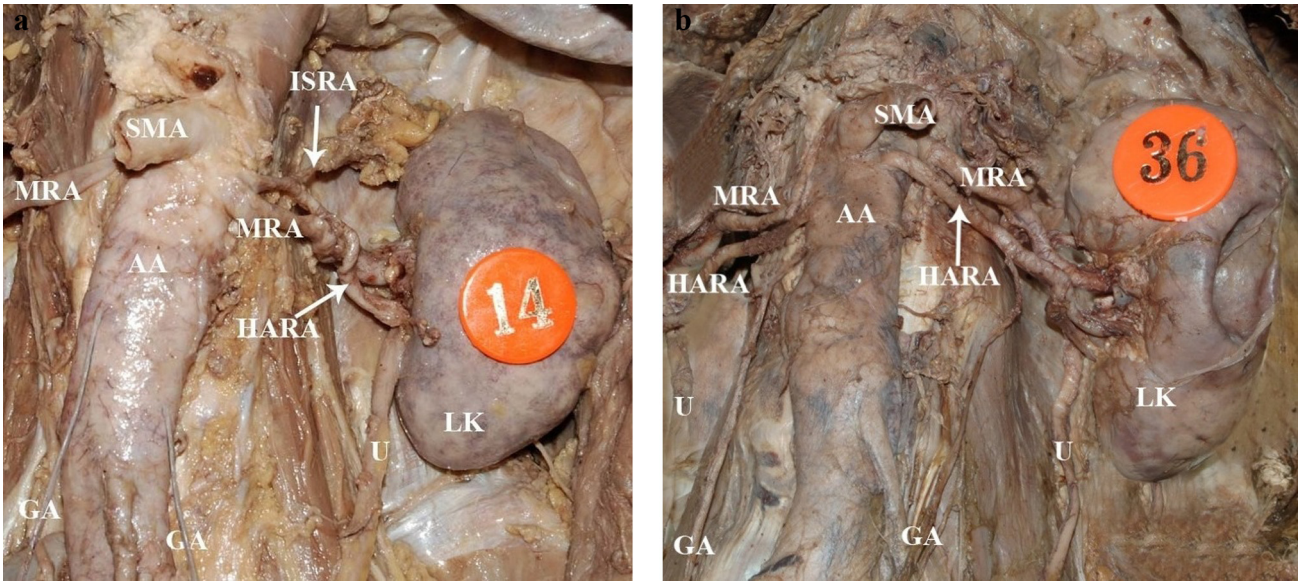


**Fig. 2.** (a) Hilar accessory renal artery arose from the aorta passed in front of main renal artery to end in hilum. It gave inferior suprarenal branch. (b) Hilar accessory renal artery (HARA) arose from lateral aspect of abdominal aorta and it gave gonadal vessel (GA).

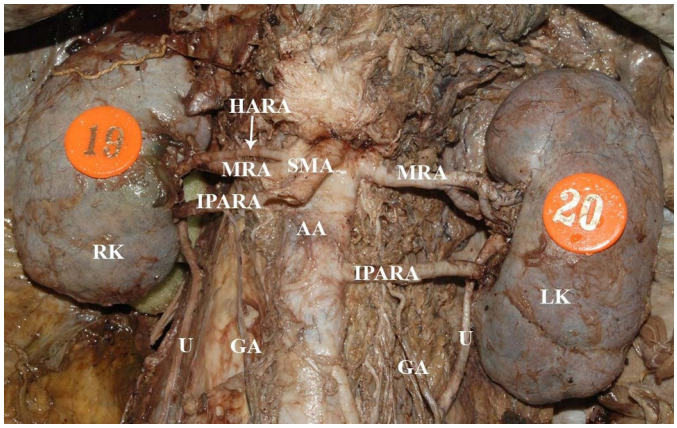


**Fig. 3.** (Right side) Hilar accessory renal artery (HARA) passed anterior to main renal artery and inferior vena cava to end in hilum. Inferior polar accessory gave gonadal and passed anterior to pelviureteric junction to end at inferior pole. (Left side) Inferior polar accessory renal artery gave gonadal artery and then passed anterior to pelviureteric junction to end at inferior pole.

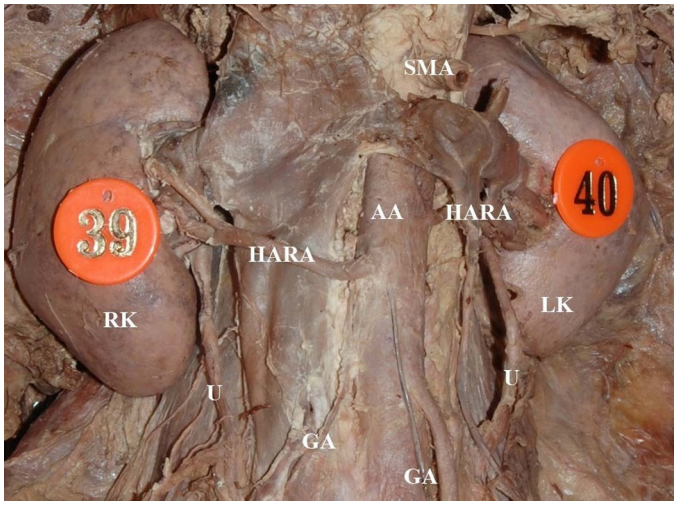


**Fig. 4.** Hilar accessory renal artery (HARA) arose from anterolateral aspect of abdominal aorta (AA) passed in front of inferior vena cava and anterior to renal pelvis (main renal arteries lies behind the renal veins).

We found four (8% of 50 kidneys) lobulated kidneys but none of them showed associated accessory renal arteries indicating that the accessories can occur without any associated anomalies of the kidney (Fig. 4).[11]

As quoted by Gupta et al., Yeh and his colleagues found the precaval arteries may impinge on the inferior vena cava and obstruct the venous flow.[12] We found a hilar accessory, inferior polar accessory artery, and an anterior division of right renal artery coursing anterior to vena cava. In addition, five accessory arteries to the lower pole traversed anterior to pelviureteric junction. Such vessels may play a role in hydronephrosis.

Some authors proved that the incidence of accessory renal arteries indicates the disturbance in development of vessels and associated with the abnormalities in the form as well as the position of the kidneys. So far, we observed no such recorded abnormality in the kidneys.

Of a total of 90 patients investigated by Ooi et al., a diagnosis of secondary hypertension was obtained in 39 patients and primary hypertension in 51 patients.[13] An accessory artery was present in sixteen of fifty-one (31%) patients with primary hypertension whereas it was present in only four of thirty-nine (10%) patients with secondary hypertension. The differences in distribution of the accessory artery in the two groups are statistically significant. In addition, Bude et al. showed that patients with the stenosis of one or more accessory renal arteries, with patent main renal artery significantly exhibited renovascular hypertension.[14]

These incidences prove that we need to screen the hypertensives for accessories before performing any interventions on them.

Accessory renal artery or a prehilar branch is smaller in size than the main renal artery and hence may not compress main renal artery. Accessory renal artery entering the lower pole can produce ureteric obstruction and subsequent hydronephrosis if it crosses anterior to ureter.

The accessory renal arteries have been associated with arterial thrombosis and stenosis. Considering such kidneys for grafting would invariably endanger both living donor and recipient.

## 5. Conclusion

Accurate evaluation of the accessory renal arteries is important for screening the donors and laparoscopic surgeries on posterior abdominal wall as the operative visibility as well as surgical exposure is very limited making the details of the arteries difficult to appreciate. As accessory arteries supply the specific segments of the kidney, identification of such arteries is essential to prevent the function loss of the kidney after the renovascular grafts, transplantations. Knowledge of the branches arising from such accessories prevents the damages to the gonads as well as to the suprarenals.

## Conflicts of interest

The authors have none to declare.

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