

## A STUDY OF VARIOUS TYPES OF ACCESSORY RENAL ARTERIES

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### ABSTRACT

**Context:** Knowledge of the variations of the renal artery is important with increasing of renal transplants, vascular reconstructions and various surgical and radiologic techniques of renal vessels

**Material and Methods:** The study of renal arteries and their variations were done in 50 sides of 25 embalmed human cadavers in the routine educational dissection of I M.B.S students for three consecutive years (2013-2016) in our department of anatomy. Exposure of the kidneys and the renal vessels were done following the standard dissection procedures. Variations of the renal arteries were observed carefully and recorded.

**Results:** The accessory renal arteries observed in the present study (24%) were grouped under the types 1 to 7 following the earlier classification [1] Type 1 was found bilaterally in a male and in a female cadaver. Type 2 was found unilaterally in a male cadaver on the right side. Type 3 was found unilaterally in a female cadaver on the right side. Type 7 was found bilaterally in a male and in a female cadaver and unilaterally in 2 male cadavers on the left side.

**Conclusion:** The knowledge of these variations provides safety guidelines for endovascular procedures like therapeutic embolization and angioplasties. The knowledge of variations reported here is very useful for radiologists, urologists and surgeons

**KEY WORDS:** Renal transplant, embolization, angioplasties.

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### INTRODUCTION

The renal arteries arise from abdominal aorta below the origin of superior mesenteric artery, on each side. Near the hilum of the kidney, each renal artery divides into anterior and posterior branch, which in turn divides into number of segmental arteries supplying the different renal segments. The primitive kidney is a segmental organ, and its primitive vessels are probably segmental, i.e., one artery for each segment, so that the persistence of the embryonic condition would mean that each

kidney, instead of being supplied by a single renal artery, might receive from two to five renal arteries. Such supernumerary vessels represent a primitive condition, and the accessory arteries may arise close together from the aorta, or their points of origin may be widely separated.

### MATERIALS AND METHODS

The study of renal arteries and their variations were done in 50 sides of 25 embalmed human cadavers (M: 17, F: 8) in the routine educational dissection of I M.B.S students for three

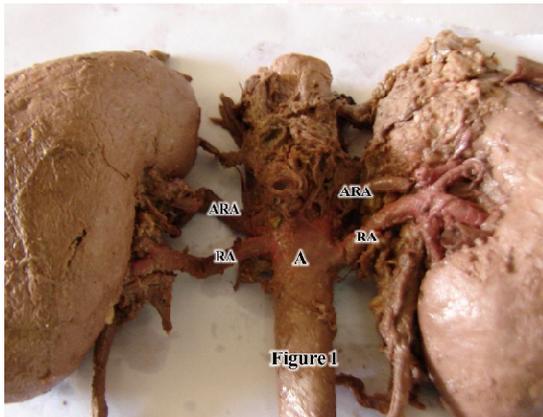
consecutive years (2013-2016) in our department of anatomy. Exposure of the kidneys and the renal vessels were done following the standard dissection procedures. Variations of the renal arteries were observed carefully and recorded.

## RESULTS

The accessory renal arteries arose from twelve sides in the present study.

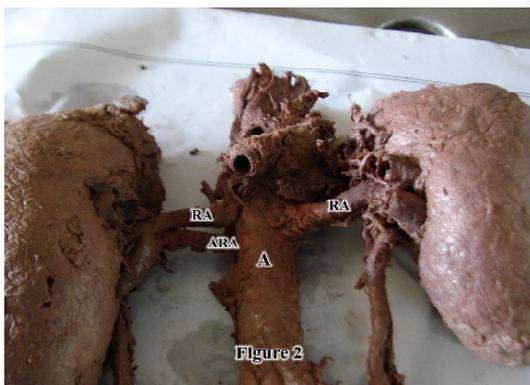
**Case series 1:** In a male and in another female cadaver, bilateral accessory renal arteries took origin from the aorta just above the normal renal arteries and entered the hilum (Fig.1). Accessory renal arteries on the right side divided into apical, anterior and posterior segmental arteries and on the left side divided into apical and posterior segmental arteries.

**Fig. 1:** Type 1- Two artery type: Bilateral accessory renal arteries above the origin of renal arteries reaching the upper pole of both kidneys.



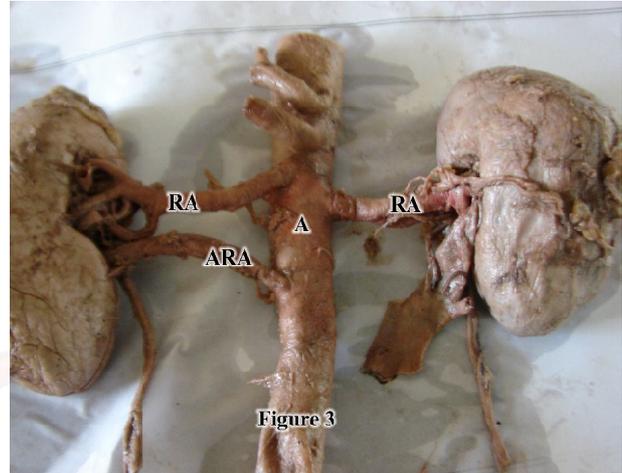
**Case series 2:** In a male cadaver on the right side, the accessory renal artery took origin from the aorta just below the normal renal artery and entered the hilum crossing each other to supply the upper pole of right kidney (Fig.2)

**Fig.2:** Type 2- Superior polar type: Right accessory renal artery below the origin of renal artery crossing from behind to reach the upper pole of kidney.



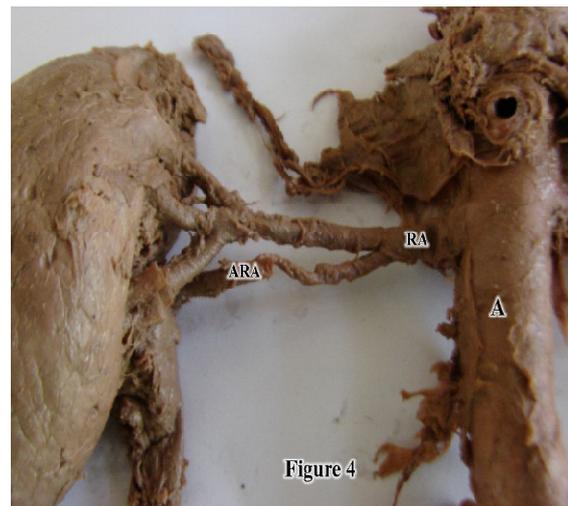
**Case series 3:** In a female cadaver on the right side, the accessory renal artery took origin 3.5 below the normal renal artery from the aorta and entered the lower pole of the kidney to become inferior polar artery (Fig. 3)

**Fig. 3:** Type 3- Inferior polar type- Right accessory renal artery below the origin of renal artery reaching the lower pole of kidney.



**Case series 4:** In a male cadaver and in another female cadaver on both sides, the inferior polar arteries arose from the renal arteries just 0.5 cm from the origin of renal arteries from aorta and entered the lower poles of kidneys of both sides (Fig. 4) This type was also seen unilaterally in 2 male cadavers on left side.

**Fig. 4:** Type 7- Inferior polar artery from renal artery- Right accessory renal artery from renal artery entering the inferior pole of kidney.



## DISCUSSION

The earliest record about accessory renal arteries seem to be that of Eustachius [2] made in 1552 on copper plates, which were published in 1714 by Lancisi[3]. According to Graves [4], any

artery arising from the aorta in addition to the main renal artery should be named 'accessory' and the renal arteries arising from sources other than the aorta should be called 'aberrant'.

Accessory renal arteries have been reported to occur in 26% of individuals [5]

The earlier classification [1] of accessory renal arteries which most frequently occur is as follows:

Type 1: Two separate renal arteries arise from the side of the aorta to supply the kidney. The two arteries enter the hilum of the kidney dividing, into two or more branches. This variety may be called the two-artery type.

Type 2: A main renal artery arises from the aorta in the normal manner, but a second accessory, artery arises from the aorta a variable distance away, passing directly from the aorta to the upper pole of the kidney. This may be called the superior polar type.

Type 3: The main renal artery arises from the side of the aorta and passes to the hilum in the normal manner. An accessory renal artery arising separately from the aorta a variable distance from the main trunk passes to the lower pole of the kidney. This is called the inferior polar type.

Type 4: Three renal arteries arise from the side of the aorta and pass separately to the hilum of the kidney. This is called the three-artery type.

Type 5: Four renal arteries arise from the aorta and pass separately to the hilum. This is called the four-artery type.

Type 6: The accessory artery arises from the common, external or internal iliac, rarely from the hepatic, middle sacral, spermatic and inferior phrenic, lumbar or even pancreatic or colonic arteries. This may be called the extra-aortic accessory type, and is quite rare as compared to the previously described types.

Type 7: Superior or inferior polar arteries arise from a single normal renal artery before it enters the kidney

Case series 1,2,3,4 come under types 1, 2, 3, 7 respectively in the present study and other types were not observed. Type 1 was observed in 4 sides (R:2, L:2), type 2 in 1 side(R), type 3 in 1 side (R) and type 7 in 6 sides (R:2, L:4)

There are other classifications of supernumer

ary renal arteries [6].According to this classification, there are three types and they are as follows:

1. Supernumerary renal arteries originating from the aorta
2. Supernumerary renal arteries originating from main renal arteries
3. Supernumerary renal arteries that can come from other sources.

The distance between the origins from the aorta of the double renal arteries was highly variable, with an average ranging between 1-2 mm and 4-6 cm [7] Embryological explanation of these variations has been given by Felix [8]. In an 18 mm foetus, the developing mesonephros, metanephros, suprarenal glands, and gonads are supplied by nine pairs of lateral mesonephric arteries arising from the dorsal aorta. These arteries are divided into three groups as follows: 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 in multiple renal arteries.

An accessory renal artery may not only be the cause of pathological conditions like hydronephrosis, but that they may play an important part in producing serious complications during operations upon the kidney, such as nephrectomy and its knowledge is useful for the surgeons

## ABBREVIATIONS

**RA** - Renal artery

**ARA** - Accessory renal artery

**A** - Aorta

**Conflicts of Interests: None**

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