

Variations in the Branching Pattern of Renal Arteries and its Clinical Significance

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Abstract: A single renal artery to each kidney is present approximately 70% of individuals. The arteries vary in their level of origin and in their calibre, obliquity and in their precise relations. Near the renal hilum, each artery divides into anterior and posterior divisions and these divide into segmental arteries supplying the renal vascular segments. The materials were 35 formalin fixed cadavers irrespective of the sex which were used for the routine dissection of the undergraduate students in the Department of Anatomy. Single renal artery was observed in 71.42% originating from abdominal aorta. Accessory renal arteries were seen in 27.14% originating from abdominal aorta. Extrahilar branches arising from renal arteries were observed in 27.15% Of the specimens studied. The knowledge of the possible variations of renal arteries is necessary during renal transplantation surgeries, urological procedures and angiography of the renal arteries.

Keywords: renal artery, kidney, hilum, transplantation.

INTRODUCTION

A single renal artery to each kidney is present approximately 70% of individuals. The arteries vary in their level of origin and in their calibre, obliquity and in their precise relations. In its extra renal course each renal artery gives off one or more inferior suprarenal arteries, a branch to the ureter and branches which supply perinephric tissue, the renal capsule and the pelvis.

Near the renal hilum, each artery divides into anterior and posterior divisions and these divide into segmental arteries supplying the renal vascular segments. Accessory renal arteries are common (30% of individuals), and usually arise from the aorta above or below (most commonly below) the main renal artery and follow it to the renal hilum. They are regarded as persistent embryonic lateral splanchnic arteries. Accessory vessels to the inferior pole cross anterior to the ureter and may by obstructing the ureter, cause hydronephrosis. Rarely accessory renal arteries arise from the celiac or superior mesenteric arteries, near the aortic bifurcation or from the common iliac arteries [1]. The knowledge of the possible variations of renal arteries is necessary during renal transplantation surgeries, urological procedures and angiography of the renal arteries.

MATERIALS AND METHODS

The materials were 35 formalin fixed cadavers irrespective of the sex which were used for the routine dissection of the undergraduate students in the Department of Anatomy. The kidneys and their arteries were explored and variations of renal arteries were noted (70 kidney specimens). The renal veins were also reflected for a proper view of the arteries. Observations were made as to arteries entering the kidney at the hilum, extrahilar branches from the renal artery and accessory renal arteries (branches from the aorta other than the renal artery).

OBSERVATIONS

RA-Renal Artery ARA-Accessory renal artery
IVC-Inferior venacava SMA-Superior mesenteric artery
RV-Renal vein U-Ureter RK-Right kidney EHA-
Extrahilar artery.

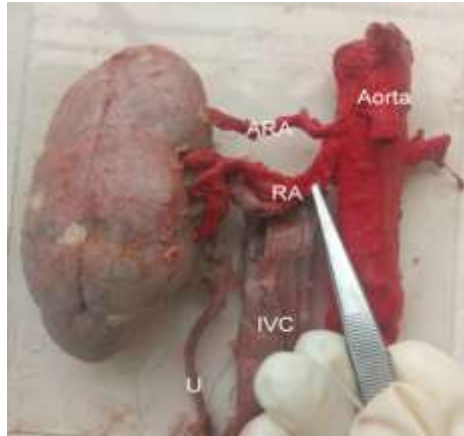


Fig-1: Accessory renal artery

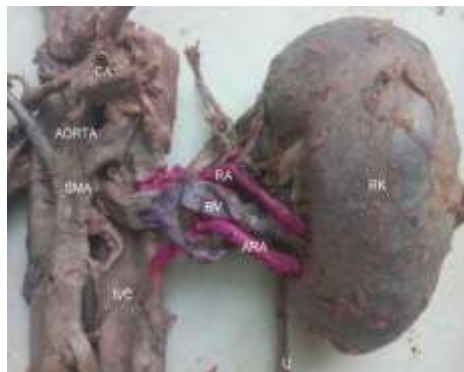


Fig-2: Accessory renal artery crossing renal vein



Fig-3: Extrahilar branches to the lower pole of kidney



Fig-4: Extra Hilar branches

**Fig-5: Extrahilar Branches****RESULTS**

Observations were made of single renal artery in 71.42% originating from abdominal aorta. Accessory renal arteries were seen in 27.14% originating from abdominal aorta.

Observations were also made with extrahilar branches arising from renal arteries in 27.15% of the specimens studied.

Table-1:

Arterial features	Right kidney	Left kidney	Total	%
Single renal artery	26/35	24/35	50/70	71.42%
Accessory renal artery	9/35	10/35	19/70	27.14%

Table-2:

Arterial features	Right kidney	Left kidney	Total	%
Extrahilar branches to superior pole	7/35	4/35	11/70	15.7%
Extrahilar branches to inferior pole	4/35	5/35	9/70	12.8%

DISCUSSION

The importance of the blood supply to the kidneys has led various researchers to study the anatomical variations to be studied in detail. A study by Jigne Kares *et al.*, found the origin of the renal artery from the abdominal aorta at the level of the Superior mesenteric artery and just above the origin of the Inferior mesenteric artery. It was also noted that the arteries entering the lower pole of the kidney is more than that piercing the upper pole [2]. Budhiraja in his study called the variation as supernumerary and they originated from the abdominal aorta in 47.3% and from the main renal artery in 12.2% [3].

A study on 60 formalin fixed adult kidneys by Ecaterine *et al.*, concluded that the branching of the renal artery was prehilar in 81.67% and hilar in 10%. It was also found that in 53% segmental arteries arose independently from renal artery branches [4]. In a study by Swapna and Renuka single renal arteries were seen in 85.18% of cases. Upper segmental artery was absent in 6 kidneys. Prehilar branching pattern was observed in 13.4% [5]. Among 30 kidneys dissected by Sharmila *et al.*, normal pattern of blood supply to the kidney was observed in 86.6%. Accessory renal arteries were found in 13.3%, extrahilar branches arising from the renal artery was observed in 10.3% [6].

Bilateral variations in the blood supply of kidneys was pointed out by Humberto Ferriera Arguz in

a male cadaver aged 65 years. In his study the right and left kidney received three direct branches from the abdominal aorta [7]. A study on 72 kidney specimens by S. Trivedi *et al.*, by dissection, corrosion cast and radiographic methods was done. The most common finding was the anterior division dividing into upper and lower branches, which further divided into apical and upper segmental branches. Understanding of branching pattern is important in proper interpretation of radiograph of renal vasculature [8].

A case report on hydronephrosis being caused by an aberrant renal artery has been reported by Byoung Seok Park *et al.*, in a 36 year old woman [9]. Variations in renal artery in Kenyan population by dissecting 356 kidneys from 78 cadavers was studied by Julius A Ogengo *et al.*, additional arteries occurred in 14.3% of cases. In 82.4% of these there was one additional artery. 76.4% showed hilar, 21.6% showed prehilar and 2% inter paranchymal branching [10].

A study by Gyan Prakash and Bhatnagar on variations in arterial pattern of upper segmental renal artery and its relations with collecting system of ducts in human kidneys was done by dissecting 50 human kidneys of both sexes. It was reported that upper segmental artery was found in 98% and absent in 2% [11].

In the present study the extrahilar branches were 27.14% as compared to other studies and hence its relations to other hilar structures become very important. Knowledge of understanding of the branching pattern of the renal arteries becomes important to the urologists during renal transplantation surgeries, hydronephrosis and renal angiograms

CONCLUSION

The knowledge of the possible variations of renal arteries is necessary during renal transplantation surgeries, urological procedures and angiography of the renal arteries.

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