

BILATERAL VARIATION OF RENAL ARTERY AND ITS CLINICAL SIGNIFICANCE IN NORTH INDIAN POPULATION

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ARTICLE INFO

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Key words: Renal artery, Bilateral, Variations, Clinical significance

ABSTRACT

Background: Classically each Kidney is supplied by a single renal artery originate from abdominal aorta. With the advent of laparoscopic renal surgeries and donor nephrectomies, it becomes mandatory for the surgeons to understand the abnormality or variations in the renal vasculature. The aim of present study is to highlight incidence of bilateral variations of renal artery in North Indian Population.

Material and Methods: The materials used for present study comprises 56 adult cadavers of both sexes (40 male and 16 female) from North Indian origin. During routine abdominal dissection conducted for medical undergraduates at Department of Anatomy, kidneys along with their arteries were explored and the morphological variations of renal arteries were recorded.

Results: We observed variations of renal arteries in 22 cadavers (39.2%). Bilateral variation were present in 12 cadavers (21.4 %), unilateral in 10 cadavers (17.8%). The unilateral variation was present right side in 3 cadavers (5.3%) and left side in 7 cadavers (12.5%).

Conclusion: Awareness of bilateral variations of renal artery is necessary for surgical management during renal transplantation; repair of abdominal aorta aneurysm, urological procedures and for angiographic interventions.

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INTRODUCTION

Anatomical knowledge of the variations of the renal artery has grown in importance with increasing numbers of renal transplants, vascular reconstructions and various surgical and radiologic techniques being performed in recent years. 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 variations in the renal arteries are considered critical issues that surgeons should have a thorough envision and appreciation of the condition. Accessory renal arteries constitute the most common, clinically important vascular variant and are seen in up to one-third of patients. The presence of unusual branching patterns of the renal arteries is not uncommon. In 70% of cases there is a single renal artery supplying each kidney by Standring S. Gray's Anatomy ^[1], multiple renal arteries are unilateral in approximately 30% of patients and bilateral in approximately 10%. Variations in the pattern of renal arteries have been reported more frequently than other large vessels in the literature and alternative

nomenclatures have been used to describe the same. The main aims of this study is to highlight incidence of bilateral variations of renal artery and its Clinical significance in North Indian Population and review of literature is to bring awareness to clinicians about the bilateral variations in the blood supply of the kidney. This knowledge is essential when a surgical approach is made to the abdominal aorta, which includes the basic anatomical relationships of the neighbouring tissues, the important variations in the origin of the aortic branches and applied anatomy, which are not only helpful for the vascular surgeons but also to those who study fluid dynamics ^[9].

MATERIALS AND METHODS

In the present study observations were made on the cadavers while they were used for routine dissection classes for medical undergraduate students over a period of five years. The materials used for present study comprises 56 adult cadavers of both sexes (40 male and 16 female) in the department of anatomy Govt. Medical College Ambedkar Nagar and S.R.M.S. Institute of Medical Sciences Bareilly U.P. The embalmed cadavers' dissections

were performed on the abdomen and posterior abdominal wall carefully. Kidneys and its surrounding vessels were studied for the presence of bilateral and unilateral variation. This was an observational study with no usage of experimental instruments. Appropriate measurements were taken by calipers and measuring tape, the specimens were photographed and the findings were appropriately documented.

RESULTS

In the present study out of 56 cadavers showed the presence of variations of renal arteries in 22 cadavers (39.2%). We found bilateral variation in 12 cadavers (21.4 %; figure1, 2), unilateral in 10 cadavers (17.8%; figure3, 4). The unilateral variations were present right side in 3 cadavers (5.3%) and left side in 7 cadavers (12.5%; figure 3, 4) shows in table 1. In two of cadavers we found Right Testicular Artery origin from Accessory Right Renal Artery and Right Renal Artery (figure; 2, 4).

Table: 1Incidence of renal artery variations in North Indian population.

	Total Variation (%)	Bilateral (%)	Unilateral (%)	
Cadavers Studied (56)	22 (39.2%)	12(21.4%)	10(17.8%)	
			Right side	Left side
			3 (5.3%)	7 (12.5%)

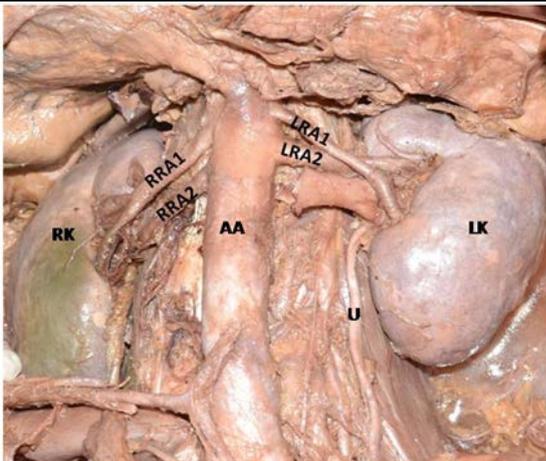


Figure : 1 Dissection of posterior abdominal wall showing bilateral double Renal arteries. (RRA1: Right Renal Artery1; RRA2: Right Renal Artery2; LLA1: Left Renal Artery1; LRA2: Left Renal Artery2; AA: Abdominal Aorta; RK: Right Kidney; LK: Left Kidney; U: Ureter)

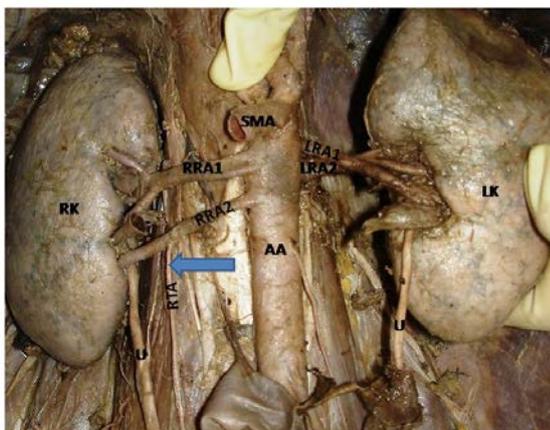


Figure: 2 Dissection of posterior abdominal wall showing bilateral double Renal arteries and Right Testicular Artery origin from Accessory Right Renal Artery with arrow. (RRA1: Right Renal Artery1; RRA2: Right Renal Artery2; LLA1: Left Renal Artery1; LRA2: Left Renal Artery2; AA: Abdominal Aorta; RK: Right Kidney; LK: Left Kidney; U: Ureter; RTA: Right Testicular Artery; SMA: Superior Mesenteric Artery)

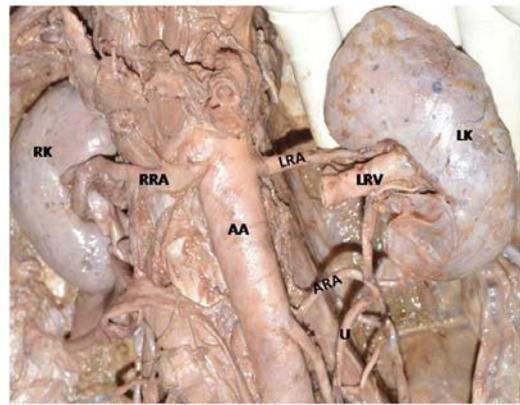


Figure :3 Dissection of posterior abdominal wall showing Unilateral variation of Left Renal artery. (RRA: Right Renal Artery; LRA: Left Renal Artery; ARA : Accessory Renal Artery; AA: Abdominal Aorta; RK: Right Kidney; LK: Left Kidney; LRV: Left Renal Vein; U: Ureter)

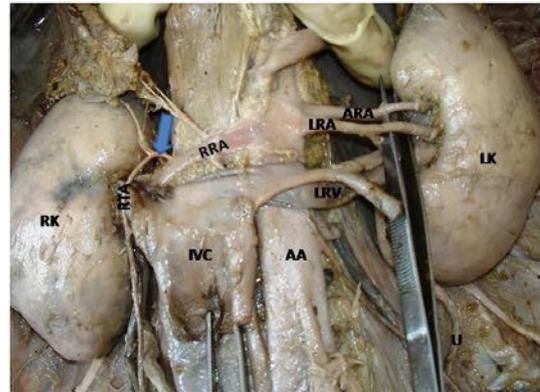


Figure :4 Dissection of posterior abdominal wall showing Unilateral variation of Left Renal artery and origin of Right Testicular Artery from Right Renal Artery with arrow. (RRA: Right Renal Artery; LRA: Left Renal Artery; ARA : Accessory Renal Artery; AA: Abdominal Aorta; IVC: Inferior Vena Cava; RK: Right Kidney; LK: Left Kidney; LRV: Left Renal Vein; U: Ureter)

DISCUSSION

Knowledge of variations of blood vessels in the renal hilar region is important during operative, diagnostic and endovascular procedures in the abdomen. Incidence of renal failure being on the rise with renal transplant being the definitive treatment option has further enhanced the importance to investigate the variable renal vasculature. The various types of (accessory, additional, supplementary and aberrant) renal arteries, their positions, method of entry to the kidney and segmentation were studied extensively by number of authors [10, 11]. Accessory renal arteries constitute the most common, clinically important vascular variant and are seen in up to one-third of patients. Classically, and in 75% of the people, the kidney is supplied by a single renal artery; about 25% of the adult kidneys have 2 or 4 renal arteries. It is a misnomer to call such vessels as accessory; aberrant or even supernumerary, because they are not extra but essential, tissue sustaining arteries without anastomosis between them, which correspond to the segmental branch of a single renal artery [2]. According to Graves 1956 [3], 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'. Most of the abnormalities in the renal arteries are due to the various developmental positions of kidney [4]. The kidneys begin their development in the pelvic cavity. During further development they ascend to their final position in the lumbar region. When the kidneys are located in the pelvis, they are supplied by branch of internal iliac artery or common iliac arteries. While the kidneys ascend to lumbar region, their arterial supply also shifts from common iliac artery to abdominal aorta [5]. Abolhassan B Shakeri 2007

reported the presence of accessory renal artery bilaterally on digital subtraction angiography performed on a renal transplant donor [7]. In a study conducted by Dhar and Lal 2005^[6] accessory renal arteries were observed in 20% of specimens. The anomaly was unilateral in 15% cases and bilateral on 5% of cases. According to Satyapal et al 2000^[4] the frequency of the additional renal arteries displays a wide range between 8.7-75 %. 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^[4]. Bordei et al 2004^[8] analyzed 272 kidneys for a study of renal vascularization and identified 54 (20%) double renal arteries and three (1.1%) triple renal arteries. Testicular arteries are paired vessels that normally originate from the abdominal aorta at the level of second lumbar vertebrae^[1]. In the present study two of cadavers we found Right Testicular Artery origin from Accessory Right Renal Artery and Right Renal Artery. A rare origin of the testicular artery from the renal artery seems to be an unrecognized variation which may be of particular importance to the radiologists and the surgeons while operating near the renal pedicle or in the retroperitoneal region. The reported incidence of accessory renal arteries has a wide range between 8.7% and 75.7%^[12]. It is important that a surgeon has prior knowledge of all such accessory renal arteries supplying the upper and lower poles because inadvertent injury or failure to restore circulation during renal surgeries and transplant operations might even result in necrosis^[13]. Accessory renal arteries are found frequently on the left side and occurrence is as high as 30-35% of cases, these arteries usually enter the upper or lower poles of the kidney^[12]. Neelesh Kanaskar et al reported 2012^[13] Double Accessory Right Renal Arteries were observed. Satheesha Nayak 2008 found an extra inferior polar artery on left side. Abdominal aorta also showed a kink at the level of origin of renal arteries^[15]. Like Ali Gurses et al 2009 reported occurrence of double hilar renal arteries bilaterally. On right side, upper renal artery gave two suprarenal branches and lower renal artery gave a testicular branch in addition to a testicular artery that arose from aorta just proximal to inferior mesenteric artery^[16]. Hemanth Kommuru et al 2012 studied 182 kidneys. 34 kidneys showed presence of one additional artery, where as two additional arteries were seen in 18 kidneys, extra artery was present unilaterally in 6 cadavers and bilaterally in 20 cadavers. 23 showed presence of superior polar artery and 29 showed inferior polar artery. They also mentioned that in one of the cases the aberrant (accessory) renal artery was a branch of superior mesenteric artery^[17].

CONCLUSION

The knowledge about these variations is of utmost importance to the urologist, surgeons dealing with kidney retrieval and transplantation, radiologists, persons performing various endourologic procedures and innumerable interventional techniques. In the majority of such situations it is the comprehensive knowledge of the renal arterial variation that remains the key issue in determining the technical feasibility of surgical interventions as well as the post operative management.

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