

STUDY ON VARIATIONS OF ANTERIOR DIVISION OF RENAL ARTERY

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ABSTRACT

Back ground: Urinary System is one of most important system among many systems in our body the most common variations in case of circulatory system usually occur in form of origin, number, length, and diameter. Based on divisions of renal artery, the renal parenchyma is divided into five segments: apical, anterior superior, anterior inferior, inferior and posterior. The main renal artery divides initially into an anterior and posterior branch. The anterior branch almost always supplies the upper, middle and lower segments of the kidney.

Materials and Methods: Fifty pairs of kidneys with intact abdominal aorta and renal artery were collected from the dead bodies obtained from the mortuary of Forensic department, JSS Medical College and Mysore Medical College and studied in JSS Medical College. For study of segmental variation corrosion cast technique method was used.

Results: In present study type I anterior division of renal artery were found in 31%, type II in 19%, type III in 8%, type IV 20% and type V in 16% of cases.

Conclusion: We observed variations in anterior division of renal artery in 100 kidneys and observed 5 types of variation. These variations are helpful for the surgeon performing major surgeries like kidney transplant and partial nephrectomy.

KEYWORDS: Renal artery, Anterior division of renal artery, Kidney transplant, Nephrectomy.

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INTRODUCTION

The kidney is one of the vital organs in the human body. It receives rich blood supply nearly 25% of the cardiac output. Embryologically development of kidney is very complex, as it develops from pronephros, mesonephros & metanephros. The human renal artery usually divides into anterior and posterior divisions just before entry into the renal parenchyma. On the basis of vascular supply, the renal parenchyma is divided into five segments: apical, anterior

superior, anterior inferior, inferior and posterior. The main renal artery divides initially into an anterior and posterior branch. The anterior branch almost always supplies the upper, middle and lower segments of the kidney. The idea of segmental anatomy of viscera seems to have started with the discovery of the bronchopulmonary segments as "territories of ventilation" in 1889 by William Ewart, father of bronchial anatomy[1,2,3]. The present study conducted for finding out the variations in anterior division of renal artery.

In the present study the classification adopted by Kher et al[4] and Verma et al[5] is followed. The following is the classification followed in this work.

5 types of the anterior division of the renal artery are described depending upon the mode of its branching.

Type I: The anterior division terminates as the anterior superior and anterior inferior segmental arteries after giving off the inferior segmental artery.

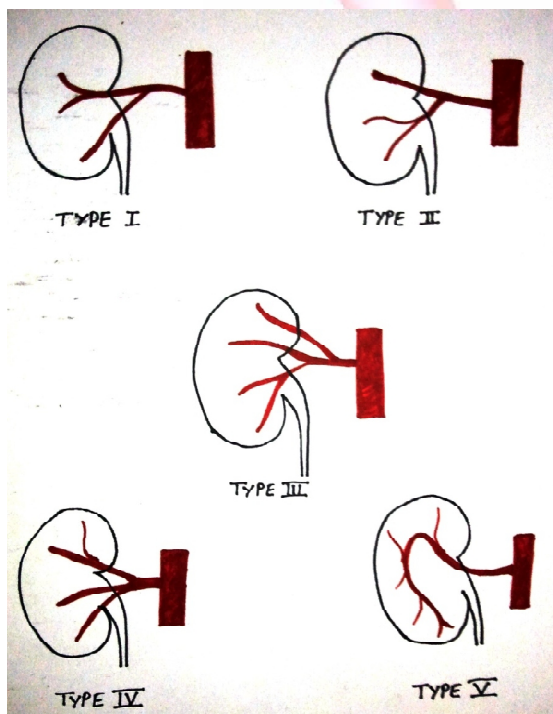
Type II: The anterior division terminates in the anterior inferior and inferior segmental arteries after giving off the anterior superior segmental artery.

Type III: The anterior division gives origin to the superior segmental artery and then to 3 terminal branches, the anterior superior, anterior inferior and inferior segmental arteries.

Type IV: The anterior division does not give off the superior segmental artery but gives off 3 terminal branches, viz., the anterior superior, anterior inferior and inferior segmental arteries.

Type V: The anterior division runs downwards (in front of the pelvis of the ureter with an outward convexity from which the superior segmental, anterior superior, anterior inferior and inferior segmental arteries arise [Fig. 1].

Fig 1: Anterior division of renal artery.



MATERIALS AND METHODS

Fifty pairs of kidneys with intact abdominal aorta and renal artery were collected from the dead bodies obtained from the mortuary of Forensic department, JSS Medical College and Mysore Medical College and studied in JSS Medical College. Once the visceral organs are removed during postmortem the right and left kidneys along with the abdominal aorta were identified. The abdominal aorta was dissected carefully approximately at the level of upper pole and lower pole of the kidney. For study of segmental variation Corrosion cast technique method was used. The method is Kidneys with intact abdominal aorta and renal artery were collected from the post-mortem bodies within 12 to 24 hours after death. The kidneys were transferred to the dissection hall using ice box. Fresh kidneys with their capsules were washed in running tap water for about 30 minutes to 1 hour.

A vertical incision was made on the anterior wall of abdominal aorta in order to expose the opening of renal arteries and any accessory renal arteries. Using 10cc syringe water was flushed slowly through the renal artery until the blood and clots present inside were thoroughly removed. Silicon rubber is injected into the renal arteries using 10cc syringe by applying mild pressure. After a sufficient amount of silicon rubber is injected the syringe is removed and a tourniquet is applied. The silicon injected inside solidifies within 2 to 3 hours.

The kidneys were finally kept in concentrated hydrochloric acid for 2 days for corrosion of the soft tissues leaving behind the silicon casts of the arterial trees. After complete corrosion, the silicon cast was kept in a gentle stream of tap water till the debris was washed away.

The silicon casts were examined. The different segments were identified and photographed.

RESULTS

In present study out of 100 kidneys type I anterior division of renal artery were found in 31%, type II in 19%, type III in 8%, type IV 20%, type V in 16% of cases [Table 1].

Table 1: The Anterior Division Of The Renal Artery.

Sex	Specimens studied	Type I, terminates as the anterior superior and anterior inferior segmental arteries after giving off the inferior segmental artery. (3 segments)	Type II, terminates in the anterior inferior and inferior segmental arteries after giving off the anterior superior segmental artery. (3 segments)	Type III, gives to the superior segmental artery ad then 3terminalbraches ,the anterior superior ,anterior inferior and inferior segmental arteries. (4 segments)	Type IV does not give off the superior segmental artery but gives off 3 terminal branches the anterior inferior and inferior segmental arteries (3 segments)	Type V runs downwads with an outward convexity from which the superior segmental, anterior superior, anterior inferior and inferior segmental arteries arise (4 segments)
	Right	12 (24%)	3 (6%)	0 (0%)	5 (10%)	2 (4%)
MALE	50	-34%	-20%	0%	-22%	-16%
	Left	5 (10%)	7 (14%)	0 (0%)	6 (12%)	6 (12%)
	Right	7 (14%)	5 (10%)	4 (8%)	4 (8%)	3 (6%)
FEMALE	50	-28%	-18%	-16%	-18%	-16%
	Left	7 (14%)	4 (8%)	4 (8%)	5 (10%)	5 (10%)
TOTAL	100	31 (31%)	19 (19%)	8 (8%)	20 (20%)	16 (16%)

In the 100 kidneys of the present study the anterior divisions of the renal artery supplies,-
 4 segments in 28 specimens (type III and IV; 28%)
 3segments in 70 specimens (type I,II and IV ; 70%)
 2 segments in 3 specimens (not typed 3%),
 It gives off 3 or 2 branches much more frequently than 4 branches.
 It is absent in 2 specimens (R11 and R44 , 2%)
 Type I is more frequent in the males, 34% as compared to 28 % in the females.
 Type II is more frequent in the males, 20% as against 18 % in females.
 Type III is more frequent in the females, 16% as compared to 0 % in the males.
 Type IV is more frequent in the males, 22% as against 18 % in females.
 Type V has equal incidence in both the males and females 16%.
 Type I show higher incidence in the right male kidneys than in left.

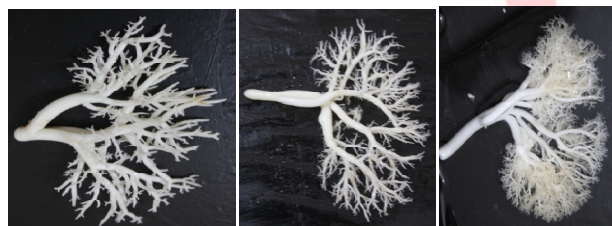
Type I: Anterior divisional branch of renal artery.



Type II: Anterior divisional branch of renal artery.



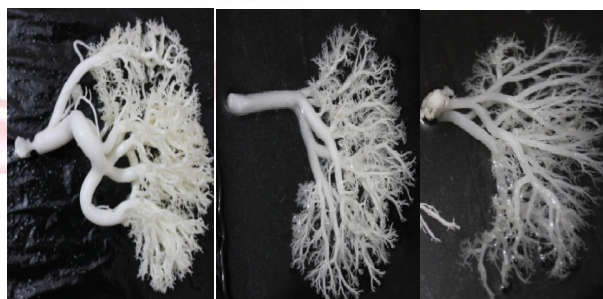
Type III: Anterior divisional branch of renal artery.



Type IV: Anterior divisional branch of renal artery.



Type V: Anterior divisional branch of renal artery.



DISCUSSION

Attention of the surgeons and anatomists has been drawn to the segmental nature of the kidney only in recent years evidently after the great advances made in surgical technique, anaesthesia, in radiological technique and in anatomical technique like making neoprene and methyl methacrylate casts of the arteries. As long as chloroform anaesthesia held sway renal surgery could not be undertaken because choloform would damage what remained of the kidney in conditions like hydronephrosis or stone in the kidney.

The results of present studies compared with previous studies [Table 2].

Table 2: The Anterior Division Of Renal Artery.

Workers	F.T. Graves	Kher et al	Verma et al	Raghavendra [6]	Present study
YearsG	1954	1960	1961	2007	2012
Kidneys studied	-	54	98	60	100
Type I	33.30%	33.30%	observed	10%	31%
Type II	30%	38.80%	observed	11.60%	19%
Type III	16.60%	27.30%	observed	13.30%	8%
Type IV				16.60%	20%
Type V			12.50%	6.60%	16%
Type VI				15%	
				20%	
				6.60%	

The anterior division of the renal artery:

1. Gives off the inferior segmental artery as the first branch to the extent of 31% in the present study and 33.3% in the works of Graves and Kher et al; this is type I that is more common than any of the other types in the present work and the previous works of the previous investigators; this is of importance in ligation of the inferior segmental artery in hydronephrosis because the inferior segmental artery is long enough by its early origin.

2. Gives off the anterior superior segmental artery as the first branch in 19% of the present specimens and in 30% and 38.8% of the specimens of the previous workers.

3. Gives off 3 or 4 branches group III of Graves[6] in 16 to 27% in the present work group III is divide into type III (anterior division giving off 4 branches, superior, anterior inferior and superior anterior inferior segmental arteries) and type IV (anterior division giving off 3 branches, the superior segmental artery not arising from the anterior division) this subtyping has been thought to be important because the superior segmental artery is often ligated in conditions like solitary cyst in the superior segment: type III is not frequent as type IV, their incidence being 8% and 20% in the present specimens.

4. Courses downwards in front of the calyces or the ureteric pelvis with a lateral convexity like

the posterior division of type I; this condition has not been taken note of by Graves. Verma et al noticed this for the first time and reported the incidence to be 12.5% in 98 specimens though they have not indicated the importance of the condition: this condition has been designated as type V in the present work. It has an incidence of 16%.

CONCLUSION

In present study observed that variations in anterior division of renal artery in 100 kidneys and observed 5 types of variation. The results are type I anterior division of renal artery were found in 31%, type II in 19%, type III in 8%, type IV 20%, type V in 16% of cases. These variations are helpful for the surgeon performing major surgeries like kidney transplant and partial nephrectomy.

Conflicts of Interests: None

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