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Original Article

STUDY OF VARIATIONS IN SUPERIOR SEGMENTAL BRANCH OF RENAL ARTERY

Chandragirish S [1], Nanjaiah C.M [2], Suhas Y Shirur [3], Shaik Hussain Saheb *[4].

[1] Assistant Professor of Anatomy, Travancore Medical College, Kollam, Kerala, India.
[2] Professor of Anatomy, JSS Medical College, Mysore, Karnataka, India.
[3] Assistant Professor of Physiology, Travancore Medical College, Kollam, Kerala, India.
*[4] Assistant Professor of Anatomy, JJM Medical College, Davangere, Karnataka, India.

ABSTRACT

Background: Based on vascular divisions the renal tissue divided into five segments that are apical, anterior superior, anterior inferior, inferior and posterior. The apical segment occupies the antero medial region of the superior pole. The superior segment includes the rest of the superior pole and the central antero-superior region. The segmental arteries of the kidney supply the organ in such a way that, each renal pole receives its own artery while, the anterior portion between the poles is supplied by an upper and lower segmental vessel. The present study concentrated on variation of superior segmental artery which is help in nephrology clinical practice.

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 superior segmental artery were found in 28%, type II in 12%, type III in 14%, type IV 20%, type V in 1% o and type VI 23% of cases.

Conclusions: We observed variations in superior segmental branch of renal artery in 100 kidneys and observed 6 types of variation. These knowledge of vascular segments of kidney helpful for the clinician to do renal transplantation interventional radiological procedures.

KEYWORDS: Renal artery, Superior segmental division of renal artery, Vascular segments, Nephrology.

Address for Correspondence: Shaik Hussain Saheb, Assistant Professor of Anatomy, JJM Medical College, Davangere, Karnataka, India. Mobile +91-9242056660. **E-Mail:** anatomyshs@gmail.com

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INTRODUCTION

John Hunter in 1974[1] described the branches of the renal artery to be functional end arteries in contrast with the free anastomosis of the veins. The application of this fact in surgery was not realized for a century and a half. It was only when segmental resection or partial nephrectomy performed with the correct appreciation of the variational anatomy of the renovascular segments was described to have a lower mortality when compared to total nephrectomy, that the importance of the knowledge of the distribution of the main branches of the renal artery in the substance of the kidney was realized by surgeons. The segmental nature of the distribution of the accessory renal arteries and branches of the renal artery was recognized

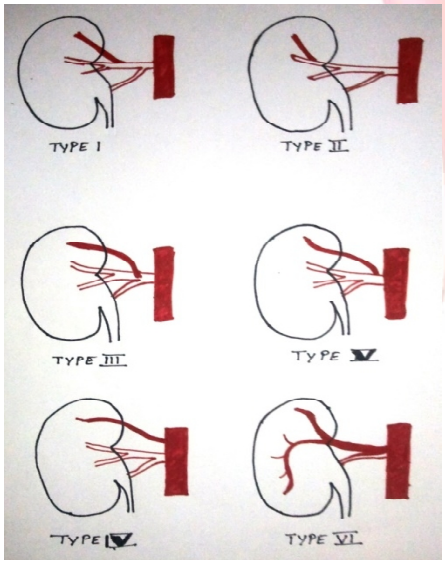
only in 1954[2,3]. In 1952, F .T. Graves came across two cases in which removal of a stone from a calyx resulted in persistent haematuria which compelled him to resort to total nephrectomy. The loss in each case of a normal kidney that was only partially disabled, prompted him to investigate the arterial distribution in the kidney substance[4].

The classification adopted in this study is based chiefly on the classification of the various types of the renal segmental arteries made by Graves. Graves described 4 types of the superior segmental artery according to its mode of origin and 3groups of the anterior division of the renal artery depending upon the mode of its termination[4].

Kher et al[5] modified the grouping of Graves and they grouped the other arteries also formerly omitted by Graves. They classified 6 types of the superior segmental artery instead of 4 types described by Graves. Six types of the superior segmental artery variation according to the different modes of origin as typed by Kher et al.

Type I: arises from the anterior division of the renal artery.
Type II: arises from the anterior superior segmental artery.
Type III: arises from the junction of the anterior and posterior divisions of the renal artery.
Type IV: arises from the renal artery.
Type V: arises from the aorta (superior accessory renal artery).
Type VI: arises from the posterior division of the renal artery[Fig 1].

Fig. 1: Superior segmental artery.



The present study about the variations of the different segmental branches of the renal artery by corrosion cast method has been undertaken because of its applied importance in making a relatively bloodless surgical approach to the kidney and in saving the healthy renal segments in partial nephrectomy.

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 type I superior segmental artery were found in 28%, type II in 12%, type III in 14%, type IV 20%, type V in 1% o and type VI 23% of cases.

In the 100 kidneys studied, the superior segmental artery:

In 28 specimens superior segmental artery is arising from the anterior division of the renal artery showing incidence of 28% which can be considered the normal type.

It Does not arise from the anterior division in 70 specimens but from other sources(types II to VI).

Type I is more frequent in the males, 30% as compared to 26% in the females.

Type VI is more frequent in the females, 28% as compared to 18% in males.

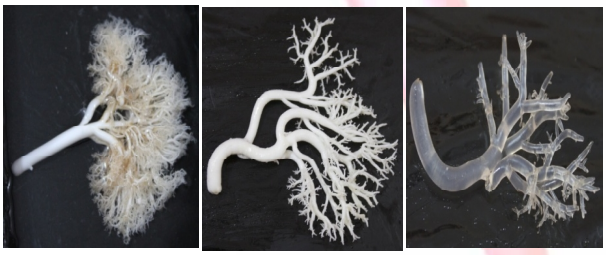
Type I is more often observed is male left kidneys (16%).

Type VI is more common in female right (20%) kidneys [Table 1].

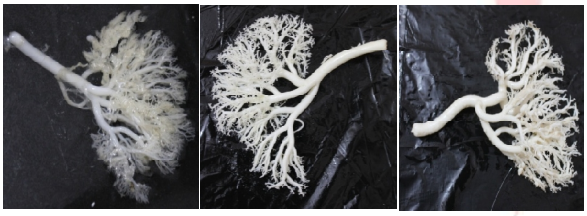
Table 1: The Superior Segmental Artery.

Sex	Specimens studied		Type I, From The Anterior Divisional Of The Renal Artery	Type II, From the anterior superior segmental artery	Type III, from the junction of the anterior and posterior division of the renal artery	Type IV, form the renal artery	Type V, from the aorta	Type VI from the posterior divisional of the renal artery
		Right	7(14%)	4(8%)	1(2%)	3(6%)	0(0%)	6(12%)
MALE	50		-30%	-14%	-10%	-18%	0%	-18%
		Left	8(16%)	3(6%)	4(8%)	6(12%)	0(0%)	3(6%)
		Right	5(10%)	4(8%)	1(2%)	6(12%)	1(2%)	10(20%)
FEMALE	50		-26%	-10%	-18%	-22%	-2%	-28%
		Left	8(16%)	1(2%)	8(16%)	5(10%)	0(0%)	4(8%)
TOTAL	100		28 (28%)	12 (12%)	14 (14%)	20 (20%)	1 (1%)	23 (23%)

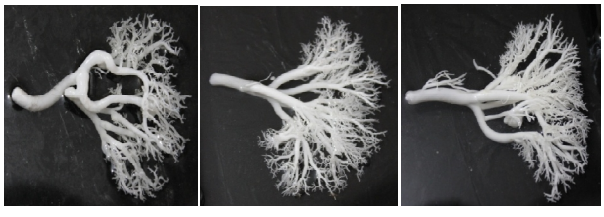
Type I: Superior segmental artery.



Type II: Superior segmental artery.



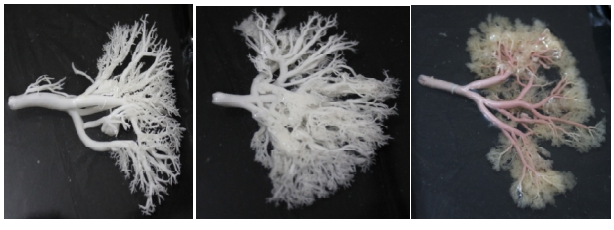
Type III: Superior segmental artery.



Type VI: Superior segmental artery.

Type V: Superior segmental artery.

Type VI: Superior segmental artery.



DISCUSSION

The superior segmental artery spring most often from the anterior division of the renal artery (type I) and the anterior superior segmental artery (type II) the incidence being 28% and 12% (total 40%) respectively in the specimens of the present study, 43.3% (type I and type II) in Graves finding[5], most frequent in Serov's[6] and 42.2% according to Chatterjee et al[7]. the incidence is lowest in the report of Verma et al[8] and highest in Singh et al (70%)[9]. It arises more often from the anterior division (type I, 28%) than directly from the anterior superior segmental artery of the renal artery.

The next commonest is type VI, the superior segmental artery springing from the posterior division of the renal artery in 26% in present specimens and 29.7% in the specimens of Verma et al. The second commonest is types III (23.03%) in Graves's work, the superior segmental artery arising directly from the renal artery or the aorta [Table 2].

Table 2: The Superior Segmental Artery Earlier Studies.

Workers	F.T.Graves	Serov	Kher et al	Verma et al	Chatterjee et al	Singh et al	Raghavendra	Present study
years	1954	1959	1960	1961	1963	1967	2007	2012
Kidnies Studied	-	100	54	98	50	60	60	100
Type I	43.03%	Most frequent	45.28%	20.45%	42.20%	70%	51.66%	28%
Type II	23.03%	-	15.05%	Absent	22%	-	25%	12%
Type III	23.03%	18%	5.66%	16.30%	5%	-	1.66%	14%
Type IV	10%	5%	1.86%	29.70%	Absent	16.70%	11.66%	20%
Type V			2.45%				1.66%	1%
Type VI			29.70%				8.33%	23%

CONCLUSION

The commonest type of the superior segmental artery is type I springing from the anterior division (28%). The present study was undertaken to observe the origin and variations of superior segmental branch of renal artery, the knowledge of renal segmental arteries to throw more light for the surgeon performing major surgeries like kidney transplant and partial nephrectomy.

Conflicts of Interests: None

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