

Original Research Article

Study of Branching Pattern of Renal Arteries in Dissected Specimen

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ABSTRACT

Background

Accessory renal artery has been associated with vascular complications, arterial thrombosis and renal artery stenosis.

Aims

To study the variations in branching pattern of renal artery in dissected kidney specimens.

Methods

The present retrospective observational study was conducted in Department of Anatomy at Dr Moopen's Medical College using 60 formalin fixed dissected kidney specimen for 5 years from 2017-2022. Kidney specimen was dissected and the variation in the branching pattern of renal artery was noted in detail. The percentage of the different types of renal artery variations was calculated.

Results

Among 60 kidney specimen, 5(8%) specimens had Accessory renal artery, 2(3%) specimen had Inferior polar artery, 1(1.6%) specimen had Superior polar artery and 9 (15%) Specimen showed pre hilar division

Conclusions

This variation of accessory renal artery has been due to persistence of lateral mesonephric artery and knowledge about this variation is important during renal surgeries.

Key-words: Branching pattern, Renal artery, Variations.

INTRODUCTION

Renal arteries are a pair of lateral branches of abdominal aorta supplying each kidney, given between the lumbar levels i.e. L1 and L2.^[1] However the classical description of the renal vasculature, formed only by one artery and one vein, occurs in less than 25% of cases.^[2] Most

often encountered morphological variations of renal artery are its unusual branches and variable number originating from it.^[3]

The unusual branches are:

1. Accessory renal artery (ARA),
2. Inferior polar artery (IPA)&
3. Early division of renal artery (EDR) (prehilar division).^[2]

The knowledge about vascular abnormality is important for surgeons prior to any surgical procedures on kidney. So, the aim of the present study is to study different types of variations in renal artery origin and branching pattern in dissected anatomical specimens.

OBJECTIVES

To study the variations in the origin and branching pattern of renal artery and associated anomalies.

MATERIALS & METHODS

This is a retrospective observational study which was conducted after taking the Institutional Ethical committee Clearance from Dr Moopen's Medical College, Kerala. In this study we have taken a sample of 60 formalin fixed kidneys, which were dissected out from 30 cadavers during routine dissection practical's to 1st year M.B.B.S students in Department of Anatomy, Dr Moopen's Medical College, Kerala from 2017 to 2022. Each kidney was neatly dissected from the posterior abdominal wall. Later the origin, course and branching pattern of each Renal artery was noted in detail. Any variation of renal arteries origin, course and distribution were studied in detail. The photographs of the renal artery with variations were taken.

Statistical Analysis

The variations in origin, branching pattern and distribution of each renal artery was noted on Excel Sheet. The percentages of the variations in branching pattern was calculated using Excel Sheet manually and the data were depicted in the form of pie chart and tables.

RESULTS

In the present study, out of 60 kidneys, four types of anomalies were observed. They are:

1. Early division of renal artery (pre-hilar division) in 9 kidneys.
2. Accessory renal artery in 5 kidneys&
3. Inferior polar artery in 2 kidney.
4. Superior Polar artery in 1 kidney.

The rest of kidney specimen exhibited normal branching pattern and division of renal artery.



Figure 1: Showing the prehilum division of Renal artery

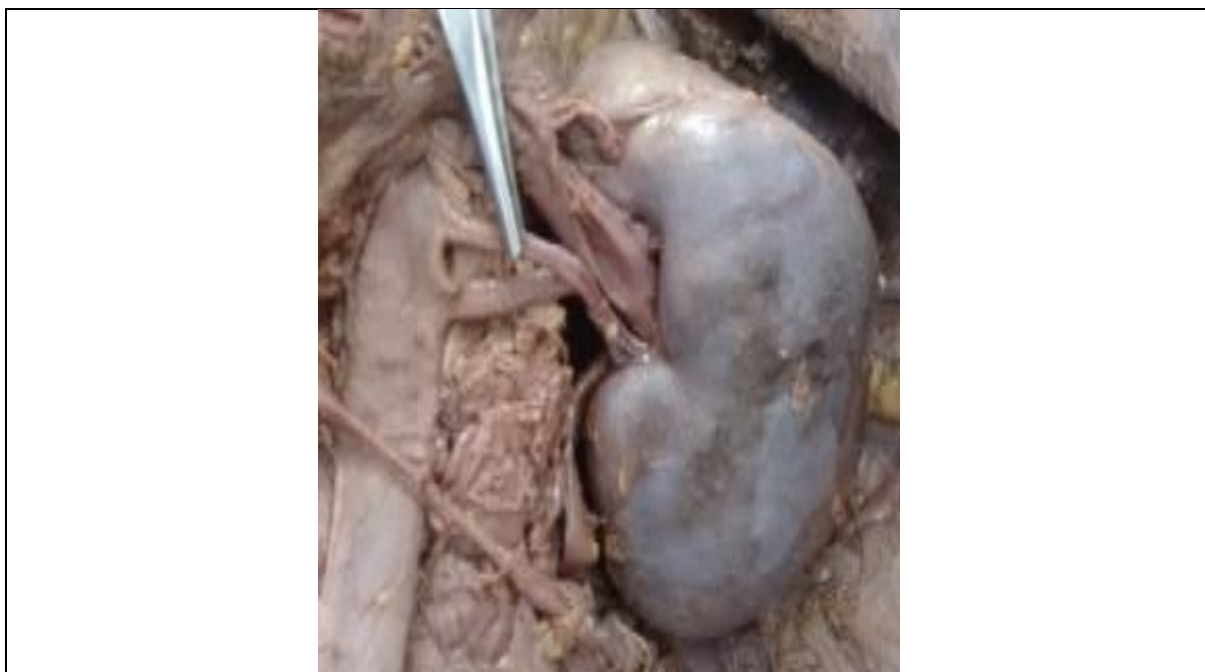


Figure 2: Showing Accessory Renal artery



Figure 3: Showing the upper polar artery

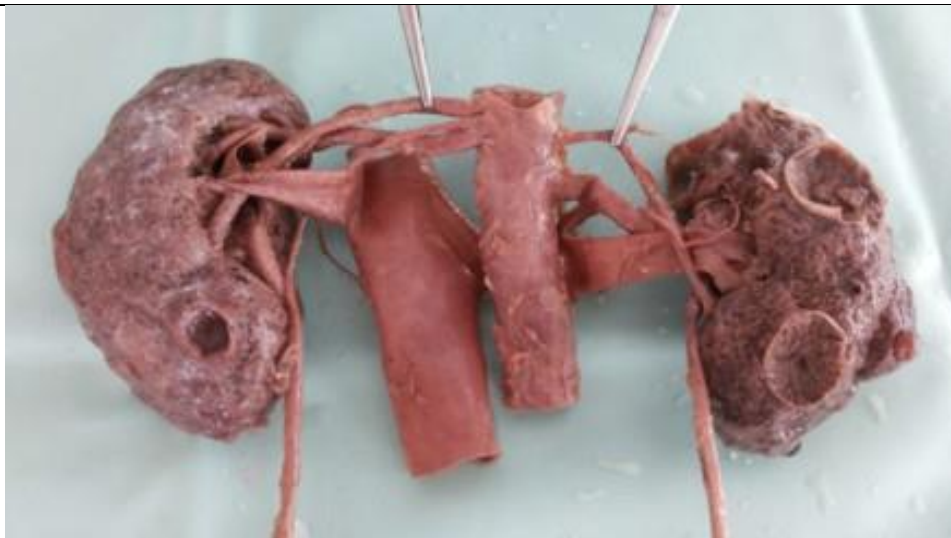


Figure 4: Showing accessory renal artery associated with polycystic kidney

Kidneys which showed bilateral accessory renal artery was associated with polycystic condition.

Sl. No	Branching pattern	Number	Percentage (%)
1.	Accessory Renal Artery	5	8.33%
2.	Inferior Polar Artery	2	3.33%
3.	Upper Polar Artery	1	1.6%
4.	Early Division of Renal Artery	9	15%
5.	Normal Branching pattern	43	71.66%
	Total	60	100%

Table 1: Showing the branching pattern of renal arteries

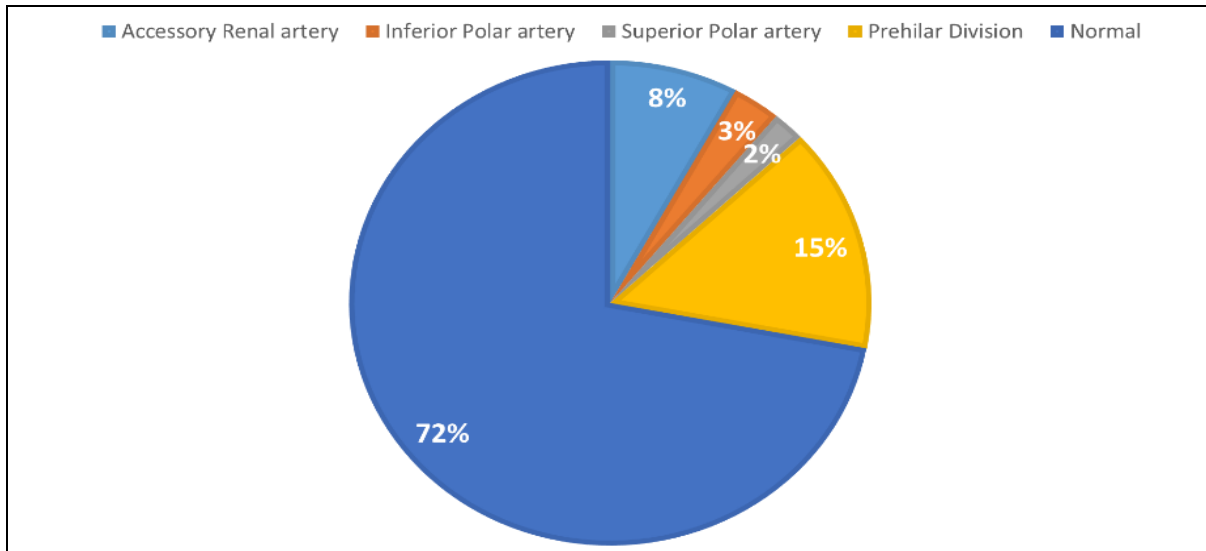


Figure 5: Pie diagram showing the percentage of branching pattern of renal arteries

Discussion

In 1963 Sykes, studied various types of Accessory Renal Artery, their positions, methods of entry into the kidney and its segmentation. According to him the two or more vessels which enter the kidney will supply separate area of kidney and do not anastomose. So, obstruction of this vessels can give raise to death of part supplied by it.^[4] The frequency of Extra Renal Artery variability is 28-30% according to anatomical and cadaveric studies.^[2]

In the present study it was 8% which was less when compared to other studies (as given in the Table-2) this may be due to racial differences among different populations.

Sl. No.	Author	Percentage (%)
1.	Satypal(2001) ^[5]	27.7
2.	Ronald(2003) ^[6]	17
3.	Avneesh Gupta(2004) ^[7]	24
4.	Ugur Ozkan(2006) ^[8]	24
5.	Srijit Das(2008) ^[9]	30-35
6.	Vrinda Anklekaret al (2013) ^[10]	25
7.	Present Study	8

Table 2: Showing the comparison of studies of prevalence of accessory renal arteries found in other studies with that of the present study

Depending on entrance into the kidney we can term Hilar, Superior polar and Inferior polar artery.^[2] In this study Inferior Polar Artery frequency was 3% and Superior Polar Artery was 1.6%. This was also when compared to previous study was less in frequency as shown in the Table-3. This Inferior polar artery may be accidentally injured during surgical resection of Kidney. Sometimes presence of inferior polar artery can also cause Obstruction of ureter pelvic junction due to pressure effect.^[2]

Sl. No.	Author	Percentages (%)
1.	Rupert (1915) ^[2]	9
2.	Bordei (2004) ^[11]	29.62
3.	Cicekcibasi(2005) ^[12]	10.5

4.	Vrinda Ankolekar et al(2013) ^[10]	10
5.	Present study	3

Table 3: Showing the comparison of studies of prevalence of inferior polar artery found in other studies with that of the present study

Branching of renal arteries into anterior and posterior division more proximal than the Renal Hilar level is called Early Division/ Pre hilar division. In the present study it was 15% which was comparatively less when compared to other studies as shown in the Table no 4.

Sl. No.	Author	Percentage (%)
1.	Safraz.et.al (2008) ^[13]	75
2.	Daescu.et.al (2012) ^[14]	81.67%
3.	Budhiraja V.et.al (2013) ^[2]	33.3%
4.	Present study	15

Table 4: Showing the comparison of studies of prevalence of early branching pattern (pre hilar branching) found in other studies with that of the present study

In 1912 Felix explained the embryological explanation for this, variations were present in 18 mm fetus & there was development of Mesonephros, Metanephros, Suprarenal gland and Gonads. They were supplied by nine pairs of Lateral Mesonephric arteries from Dorsal Aorta. These arteries were divided into 3 groups-1st and 2nd artery – Cranial, 3rd to 5th artery- Middle and 6th to 9th Artery as caudal group of Lateral Mesonephric Artery. Usually the middle group gives rise to Renal Artery. If there is persistence of extra middle, caudal group of Lateral Mesonephric artery which gives rise to the prudent extra Renal Artery/ Inferior Polar Artery.^[15]

The Knowledge about this extra renal arteries will be helpful for Urologist, Renal transplantation surgeons. In opinion of few surgeons Multiple artery would have resulted in poor outcome after transplantation which has not been proved yet.^[2]

CONCLUSION

In the present study we had less frequency of variations when compared to rest of the other studies this may be due to racial and regional differences in the study population. This anatomical knowledge of variations in renal artery branching pattern is essential for radiologists, nephrologists and urologists for interpreting the images of renal arteriogram and during surgical procedures. These variations of branching pattern of renal arteries were due to persistence of lateral Mesonephric Arteries.

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