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ORIGINAL RESEARCH

A Human Caaveric Study On Renal Artery, Its Variations And Clinical Correlation

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ABSTRACT

Introduction:-Renal arteries are paired segmental lateral branches of the abdominal aorta that emerge just below the superior mesenteric artery origin. According to Sampario and Passos these arteries are segmental vessels without anastomoses connecting them so they referred to as multiple arteries.It may present as accessory or hilar arteries as well as superior and inferior polar arteries. While renal arteries that are classified as hilar arteries penetrate the renal hilum to supply the kidney polar arteries serve the superior or inferior poles without entering the hilum.**Aim:-**study the renal vasculature and provide structural knowledge of normal and variant anatomy of vascular pattern.**Material and methods:-**The study has been conducted on 100 human cadaveric kidney specimens (50 right and 50 left of unknown age and sex of Madhya Pradesh population from the collection of Department of Anatomy of Index Medical College, Indore. **Observations:-** In the present study SRA was observed in 32% specimens while MRA were present in 68% cases which were constituted by 57% of DHA, 5% of SPA and 6% of IPA. The occurrence of SRA and SPA being more frequent on right side, and DHA along with IPA present more on left side than right side.**Conclusion:-**Understanding anatomical variations and their clinical significance for surgical planning and the interpretation of radiologic findings and renal transplantation require studies related to specific regions and populations which has been shown by the findings.

Key words:-Renal artery, Single renal artery(SRA), Double hilar artery(DHA), Triple hilar artery(THA), Superior polar artery(SPA), Inferior polar artery(IPA).

INTRODUCTION

Renal arteries are paired segmental lateral branches of the abdominal aorta that emerge just below the superior mesenteric artery origin. They pass through the hilum into the kidney where they give rise to segmental arteries. To supply organ that make up less than 1% of the total body weight, renal arteries require approximately 20% of cardiac output.[1,2]

Variants of renal arteries classified as perforating, supplementary, aberrant, supernumerary and accessory. Sampario and Passos contend that because these arteries are segmental vessels without anastomoses connecting them, they ought to be referred to as multiple arteries.[3]

It may manifest as accessory or hilar arteries as well as aberrant or superior and inferior polar arteries. While renal arteries that are classified as hilar arteries penetrate the renal hilum to supply the kidney, polar arteries serve the superior or inferior poles without doing so.[4]

Renal artery variants are frequently observed in the population, and their prevalence reveals disparities in social, cultural, and racial groups.[6] A single renal artery is found in about 70% of people. About 30% of people have accessory renal arteries, which can develop from the abdominal aorta superiorly or inferiorly to the main renal artery. Sometimes they can also arise from the common iliac arteries, the celiac plexus, or the superior mesenteric artery.[7]

Hydronephrosis can be occur by an obstructive and compressed ureter from an accessory renal artery that leads to the inferior pole. When surgery is required, such as in cases of renal transplant, urological and radiological procedures, renovascular hypertension, renal trauma, and hydronephrosis renal artery variations have a significant impact.[8] It has been shown that there are 5 segments of the human kidney, each of which has its own end artery and between which there is no collateral circulation.[5] Renal infarcts may result from ligation or any other damage to the

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renal artery. For a thorough and precise anastomosis with all of the donor kidney's arteries during a renal transplant, this needs to be taken care of.[9] As a result, they are more vulnerable to complications such as acute tubular necrosis, hypertension, hydronephrosis, and graft rejection linked to decreased graft function.[7]
Multiple renal arteries are the outcome of a deficiency in the formation of mesonephric arteries. When considering renal surgery or non-invasive diagnostic procedures for renal artery stenosis, renal artery variations must be taken into consideration.[10] In addition to altering the morphometry of the kidney, multiple renal arteries also affect hemodynamics and should be carefully inspected for any vascular malformation to prevent inadvertent harm.[11] A thorough imaging evaluation of the accessory renal artery need to be required prior to kidney transplantation, renovascular reconstruction, and other urological treatments.[7]
Surgeons, urologists, radiologists, and physicians require anatomical knowledge of the different patterns of renal vessels in the hilar area for surgical interventions, interpretation, and understanding the pathophysiology of renal illnesses.

AIM

Our primary aim is to examine the renal vasculature and To provide structural knowledge of normal and variant anatomy of vascular pattern and create a database that would aid in a variety of renal surgical procedures.

MATERIALS AND METHODS

The study has been conducted on 100 human cadaveric kidney specimens (50 right and 50 left of unknown age and sex of Madhya Pradesh population from the collection of Department of Anatomy of Index Medical College, Indore. The specimens have been obtained from cadavers during routine dissections for undergraduate MBBS students. All the specimens in the study were preserved in 10% formalin solution.Renal arteries will be observed according to their number.We will use the nomenclature of Sampaio &Passos (1992), according to thatHilar Artery is a branch of abdominal aorta that enters the kidney through hilum. Superior Polar Artery is a branch of abdominal aorta or main renal artery that pierce the kidney at superior pole. inferior polar artery is a branch of abdominal Aorta or main renal artery that pierce the kidney at inferior Pole.

OBSERVATION

Table.1:- Variations of renal artery

Number of renal artery	Right(N=50)	Left(N=50)	Total(N=100)
Single renal artery	19(38%)	13(26%)	32(32%)
multiple renal artery	32(64%)	38(78%)	68(68%)
Double hilar artery	25(50%)	32(64%)	57(57%)
Triple hilar arteries	0	0	0
Superior polar artery	3(6%)	2(4%)	5(5%)
Inferior polar artery	2(4%)	4(8%)	6(6%)

In 19 kidneys (38%) on the right side and 13 kidneys (26%) on the left side making a total 32% of all cases were presence of single renal artery. This shows that a most of kidneys in this study have typical single renal artery variations.
In present study 64% of right kidneys and 78% of left kidneys, makes an overall occurrence of 70% on both side. This observed data shows more occurrence of multiple renal arteries in the left side. DHA was observed in 25 kidneys (50%) on the right side and 32 kidneys (64%) on the left side resulting total of 57% on both sides. This is the most common type of multiple renal arteries and its presence on right side were observed more than left side. No occurrence of THA were noted in any of the kidneys examined in the present study. In the present study SPA were found in 4 right kidneys (8%) and 2 left kidneys (4%) which results in an overall of 6% of all kidneys. We observed Inferior polar artery in 3 right kidneys (6%) and 4 left kidneys (8%) which forms an overall 7% of all kidneys.In the present study we observe a very high proportion of kidneys with multiple renal arteries specifically on the left side.
Amongst the all of the types of Multiple renal arteries double hilar arteries were noted as the most common variation. We noted just 6% and 7% superior and inferior polar arteries in this study respectively which are relatively less common occurrence. No triple hilar arteries were found.

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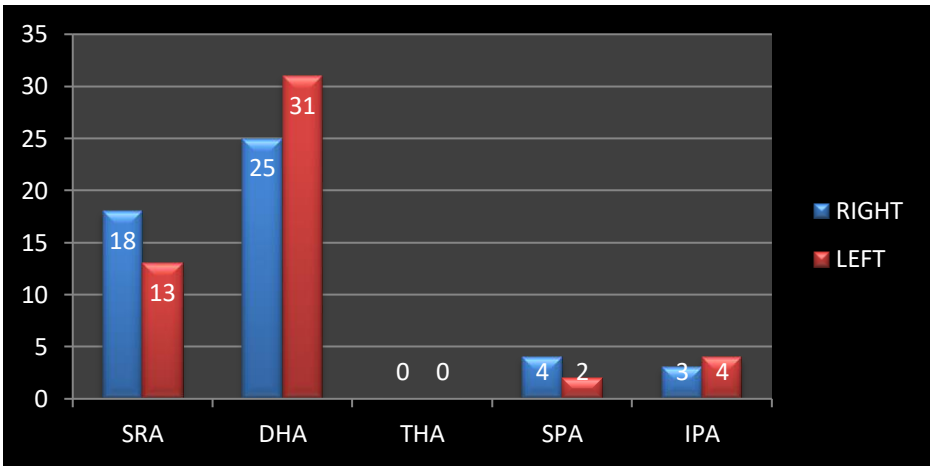
Fig.1 DHA and IPA in a Left kidney



Graph 1:- Different renal artery variation in the present study on right and left side

Table2:- Comparison of variations in renal artery patterns with other authors

Authors	Population	N	SRA	DHA	THA	SPA	IPA
Ramulu MV et al (2014)	Karnataka	50	72%	14%	-	2%	12%
Chauhan P et al (2016)	Gujrat	50	44%S	16%	8%	14%	18%
Cases C et al(2017)		583	79%	-	-	15%	5%
Salih MA et al(2018)	Sudan	50	74.5%	15.5%	-	2%	8%
Lama CP et al (2019)	Nepal	15	80%	6.66%	-	6.66%	6.66%
Mukherjee B et al(2023)	Kolkata	50	70%	14%	-	10%	6%
Present study	Madhya Pradesh	100	32%	57%	-	5%	6%

DISCUSSION

In present study showed that 32% cases had a single renal artery which is lower than reported in other studies. Highest frequency of SRA was found 82% by Khamanarong et al (2004) and 80% by Lama CP et al (2019). While the lowest observation of SRA was 23.1% in Brazil by Palmieri et al (2011).[13,16]

In present study we observed DHA 57% which is the highest according to all previous studies. Palmieri et al (2011) reported 45.5%, Budhiraja V et al (2013) reported 22.6% which are higher than other studies whereas the lowest being Khamanarong et al. (2004) reported 7% and Lama CP et al (2019) reported 6.66%.[14,4,13,16] This finding emphasizes the differences of the population studied because DHA showed to be more common in Madhya Pradesh compared with other parts of India.

This study does not identify triple renal arteries similar with previously noted Lama CP et al. (2019) and Mukherjee B et al. (2023). Budhiraja V et al (2013) recorded the highest incidence 18.8% of THA followed by 11.8% by Palmieri et al (2011).[15,16,4,14]

The occurrence of superior polar artery in the present study was found 5% which is similar to the observation of Khamanarong et al (2004) at 7% and Lama CP et al (2019) at 6.66%.[13,16]The highest cases of SPA were reported by Cases C et al (2017) at 15% and Budhiraja V et al (2013) 13.1%.[18]

In the present study Prevalence of Inferior Polar Artery (IPA) was 6% which is close to the 6% from Mukherjee B et al (2023) and 3% of Khamanarong et al (2004). Budhiraja V et al (2013) reported 7.1% and Saldarriaga et al (2008) reported 10.8% were slightly higher compaired to present study.[15,13,4] While highest

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occurrence of IPA was noted 18% by Chauhan P et al (2016) followed by 15.1% by Weld et al (2005). [20]

ln the study of Chauhan P et al (2016) where 52% kidneys found with multiple renal arteries. In the present study, no significant deference was found in the incidence of multiple renal arteries between right and left side, while multiple renal artery was reported more commonly on left side than that of right side by Harrison LH et al (1978), Singh G et al (1998), Koranafel U et al (2010).[20]

Overall most studies suggest higher percentage of SRA than DHA. THA, SPA and IPA vary among different populations . Studies of populations in Brazil by Palmieri et al (2011) and Madhya Pradesh by Budhiraja V et al (2013) along with the present study almost report increased percentage of DHA. [14,4]

CONCLUSION

Our study shows that compared to world data renal artery patterns shows marked variations with higher frequency of DHA and lower frequencies of SRA. Understanding anatomical variations and their clinical significance for surgical planning and the interpretation of radiologic findings and renal transplantation require studies related to specific regions and populations which has been shown by the findings.

To increase safety, urologists and surgeons need to be knowledgeable about the different branching patterns of the renal arteries in the hilar area. This is because the renal hilum's structure varied greatly between the left and right kidneys.Physicians must also be knowledgeable about the pathophysiology of renal disease. Ureteteropelvic blockage may also be caused by a characteristic hilar structure caused by the rotational aberration of the kidney. Because of these differences, the prior study focused more on the lateral deep incisions along the ureteropelvic junction and less on the anterior or posterior incisions in endopyelotomies.

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