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Original Research Article

COMPARATIVE STUDY OF RIGHT AND LEFT RENAL ARTERIAL PATTERNS IN HUMAN CADAVERS

R. Shalini *[1], R. Manoranjitham [2], Arunkumar K.R [3], C. Ravivarman [4].

*[1,3] Assistant Professor, Department of Anatomy, Dhanalakshmi Srinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu, India.

[2] Professor, Department of Anatomy, Dhanalakshmi Srinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu, India.

[4] MDS (Conservative Dentistry and Endodontics) Post graduate, Conservative dentistry and Endodontics Department, Adhiparasakthi Melmaruvathur Dental College, Melmaruvathur, Tamil Nadu, India.

ABSTRACT

Introduction: The renal arteries are lateral branches of abdominal aorta which divide into segmental branches to supply a segment of the kidney. Accessory renal arteries have been commonly reported in literature. The arterial branching pattern is very much varied.

Materials and Methods: The study was conducted in 30 pairs of formalin fixed human cadaveric kidneys with intact renal artery and renal veins removed along with a part of abdominal aorta and IVC. The presence of accessory renal arteries, branching pattern of renal arteries, and length and width of renal arteries were noted.

Results: Accessory renal arteries were noted in 3 kidneys (5%). One left kidney was supplied by 3 renal arteries arising from the abdominal aorta. A pair of kidneys was supplied by 2 renal arteries arising from the abdominal aorta on either side. The mean length and width of right renal artery was 37.5 ± 3.44mm and 6.51 ± 1.26mm respectively. The mean length and width of left renal artery was 28.4 ± 2.36mm and 6.24 ± 1.36mm respectively. P1 branching pattern was observed in 38.3% of the specimens, L1 pattern in 23.33% of the specimens, A1 pattern in 26.66% of the specimens, U1 pattern in 10% of the specimens and triple pattern in 1.66% of the specimens.

Discussion: The mean length and width of renal arteries of the present study were similar to the results obtained in previous studies. Accessory renal arteries are end arteries and supply a particular segment of the kidney. So the knowledge of accessory renal arteries is important. The results of the branching pattern of renal arteries were compared with the results of Fine and keen's study.

Conclusion: The knowledge of the presence of accessory renal arteries, dimensions and branching pattern of renal arteries will be helpful for urologist during renal surgeries.

KEY WORDS: Renal Artery, Kidney, Branching Pattern, Accessory Renal Artery.

Address for Correspondence: Dr. R. Shalini, MD (Anatomy), Assistant Professor, Department of Anatomy, Dhanalakshmi Srinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu-621212. India. **E-Mail:** liniram80@yahoo.com

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INTRODUCTION

Each kidney is supplied by a renal artery, which is a lateral branch of abdominal aorta at the level between L1 and L2 vertebrae. Each renal

artery divides externally into an anterior and a posterior division. The anterior division divides into 4 segmental branches, which supply the corresponding segments of the kidney [1]. The left renal artery is normally shorter in length than the right renal artery, as the abdominal aorta is present on the left side of the posterior abdominal wall [2].

There are many variations in the renal arterial patterns. Putz and Pabst have reported that the incidence of upper pole artery as a branch of renal artery is 13% and the incidence of accessory upper pole artery is 7% and accessory lower pole artery is 5% [3]. Accessory renal arteries are more common on the left side [4]. The knowledge of accessory renal arteries is important to clinicians because these arteries may cause hydronephrosis due to compression of ureter and malrotation of kidney may occur due to an inferior polar artery [5].

The diameter of renal arteries is usually 6-8mm, but it varies with the volume of the kidneys. Renal artery stenosis is associated with hypertension [6]. The present study aims to study the level of origin of renal arteries, to note the presence of accessory renal arteries, to measure the length of renal arteries from origin upto its division and width of the renal arteries and also to study the branching pattern of the renal arteries. The morphology of the renal arteries is essential during renal transplant surgeries, nephrectomy, pyeloplasty and other renal surgeries. The knowledge of renal arterial patterns is useful for radiologist to interpret renal angiograms.

MATERIALS AND METHODS

The study was conducted in 60 formalin fixed human cadaveric kidneys available in the Department of Anatomy, Dhanalakshmi Srinivasan Medical College and Hospital, India. 30 pairs of kidneys removed along with a part of abdominal aorta and inferior vena cava with renal arteries and renal veins intact was studied. The vertebral level of origin of renal arteries from abdominal aorta was noted. The branching patterns of renal arteries on both sides was noted and photographed. The presence of accessory renal arteries was noted. The length of renal artery from its origin from abdominal aorta to its bifurcation into anterior and posterior divisions was measured with a verniercaliper. The width of the renal artery before its bifurcation was measured with a verniercaliper. All the parameters were carefully tabulated and statistically analysed using Epi Info version 3.4.3.

RESULTS

Presence of accessory renal arteries: Accessory renal arteries were present in 3 kidneys- 5%. One left side kidney (1.66%) was supplied by 3 arteries (Figure1) and 2 kidneys of a pair(3.33%) were supplied by 2 renal arteries (Figure2). The other 57 kidneys were supplied by only one renal artery (95%).

Fig. 1: Left kidney supplied by 3 renal arteries.

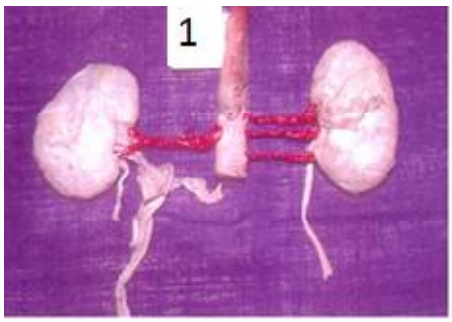
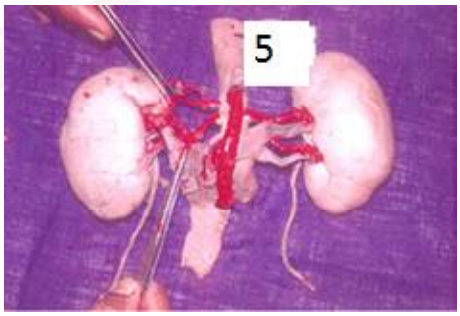


Fig. 2: Both kidneys of a pair supplied by 2 renal arteries



Level of origin of renal arteries: The right and left renal arteries were arising from the same vertebral level in 14 pairs of kidneys (46.66%).

Higher level of origin of right renal artery was observed in 10 pairs of kidneys (33.33%).Higher level of origin of left renal artery was observed in 6 pairs of kidneys (20%).

Length of renal artery from its origin from abdominal aorta to its bifurcation into anterior and posterior divisions:

The mean length of the right renal artery was 37.5 $\pm$3.46 mm.The mean length of the left renal artery was 28.4 $\pm$ 2.36 mm.

Width of the renal arteries before its bifurcation into anterior and posterior divisions:

The mean width of the right renal artery was 6.51±1.26 mm.The mean width of the left renal artery was 6.24± 1.36 mm. There was no statistically significant difference between the widths of right and left renal arteries.

Branching pattern of renal arteries: The branching pattern was studied according to Fine and Keen's (1960) classification based on the first branch given by the renal arteries [7].

P1 pattern- posterior division was the first branch of renal artery- observed in 23 arteries (38.3%). This pattern was observed in 13 right renal arteries and 10 left renal arteries.

L1 pattern- lower segmental artery was the first branch of renal artery- observed in 14 arteries (23.33%). This pattern was observed in 8 right renal arteries and 6 left renal arteries.

A1 pattern- apical artery was the first branch of renal artery - observed in 16 arteries (26.66%). This pattern was observed in 6 right renal arteries and 10 left renal arteries.

U1 pattern- upper segmental artery was the first branch of renal artery- observed in 6 arteries (10%). This pattern was observed in 2 right renal arteries and 4 left renal arteries.

Triple pattern- upper, lower and posterior segmental arteries were given at a same point from the renal artery- observed in one right renal artery (1.66%).

Fig. 3: Branching pattern of renal arteries.

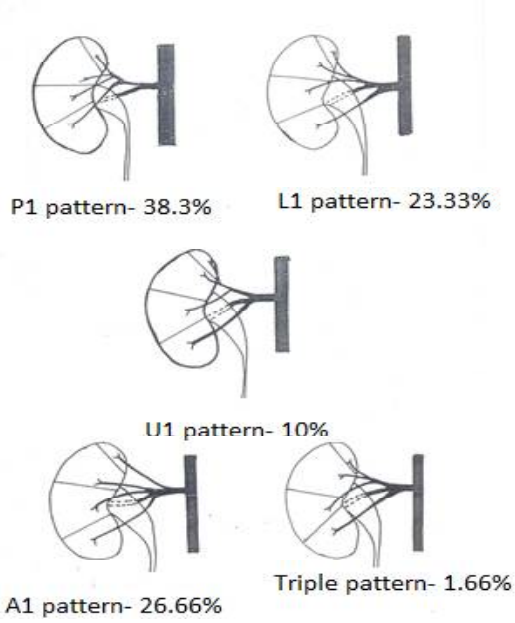


Fig. 4: Right renal artery showing L1 branching pattern and Left renal artery showing A1 branching pattern.

DISCUSSION

The accessory renal arteries are end arteries, so if they are damaged during any surgery, it will lead to ischemia of the part of the kidney supplied by it [5]. Brodei P, et al., has noted the presence of double renal arteries arising from the abdominal aorta and supplying a single kidney in 54 specimens [8]. In the study by Chandragirish S, et al., accessory renal arteries were noted in 2 specimens out of 100 specimens dissected [9]. In our study double renal arteries were present on both sides in a pair of kidneys and one left kidney was supplied by 3 renal arteries arising from the abdominal aorta. The incidence of 3 renal arteries arising from the aorta was reported to be 11.8% by Budhiraja V, et al. [10].

In our study, the right renal artery was arising at a higher level in 33.33% of the specimens and the left renal artery was arising at a higher level in 20% of the specimens and both the arteries were arising at the same level in 46.66% of the specimens. This is in accordance to the study of Vaghela BP, et al., in which the frequency of higher level of origin of right renal artery is more compared to that of the left renal artery [11]. Bergman RA, has also reported that right renal artery was arising at a higher level in 47% of the cases, left renal artery was arising at a higher level in 23% of the cases and same level of origin was seen in 30% of the cases [12].

The mean length of right renal artery in our study was 37.5 ± 3.44 mm and the mean length of left renal artery was 28.4 ± 2.36 mm. These results are in accordance with the measurements obtained by Vaghela BP, et al. In their study the length of right renal artery was 38.04 ± 4.29 mm

and the length of left renal artery was 27.04 ± 5.27 mm [11]. Saldarriaga B, et al., has also reported the average length of right renal artery as 34.6 mm and left renal artery as 28.6 mm [13].

In our study, the mean width of the renal arteries on the right side was 6.51 ± 1.26 mm and on the left side was 6.24± 1.36 mm. In the study by Vaghela BP, et al., the mean diameter of right renal artery was 4.76 ± 0.32 mm and the left renal artery was 5.22 ± 0.34 mm [11]. Tarzamni MK has reported the mean diameter of renal arteries to be 0.62 ± 0.11 cm [14].

The branching pattern of the renal arteries was studied using Fine and Keen classification [7]. The results of the present study were compared with the results of Fine and Keen's study. (Table 1)

Table 1: Comparison of branching patterns with Fine and Keen's study.

Branching pattern	Present study	Fine and Keen's study
P1 pattern	38.30%	53.30%
L1 pattern	23.30%	38.30%
U1 pattern	10%	4.70%
A1 pattern	26.66%	-
Triple pattern	3.70%	12%

P1 pattern was the most frequent pattern observed in our study and also by Fine and Keen's study. A1 pattern was not observed by Fine and Keen, but we have seen it in 26.66% of the specimens studied.

CONCLUSION

The knowledge of the presence of accessory renal arteries, dimensions and branching pattern of renal arteries is important for urologist during renal surgeries. This study will also help radiologist in the interpretation of renal angiograms.

Conflicts of Interests: None

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