Research Article

INTERNATIONAL RESEARCH JOURNAL OF PHARMACY

www.irjponline.com

ISSN 2230-8407 [LINKING]

RENAL VASCULATURE VARIATIONS USING CONTRACT-ENHANCED COMPUTED TOMOGRAPHY

Dr. Patel Pankajkumar Balubhai,[1] Dr. Hardik Arvindbhai Katrodiya,[2*] Dr. Raunak Raj[3]

[1]Assistant Professor, Department of Radiodiagnosis, Icare Institute of Medical Sciences & Research & B C Roy Hospital, Haldia, West Bengal

Address for correspondence
Email id- Senjaliyapankaj@gmail.com

How To Cite: Balubhai PP, Katrodiya HA, Raj R. Renal vasculature variations using contract-enhanced computed tomography. International Research Journal of Pharmacy, 2022;13:7:89-93.

DOI: 10.7897/2230-8407.1303190

ABSTRACT

Background: When biopsy or transplant operations are scheduled, differences in the kidney's vasculature can have a major clinical impact. In this respect, comprehensive literature data on the Indian population is lacking. However, the literature has gender-based assessments for a variety of populations from various countries.

Aim: The purpose of this study was to ascertain, by gender distribution, the prevalence of renal vein and renal artery alterations in patients undergoing abdominal contrast-enhanced computed tomography (CECT) examinations.

Methods: 320 affected individuals, equally split between the sexes, were referred for a CECT scan and showed variations in renal vein and renal artery variation. There was a gender correlation. Conclusions were reached by statistical analysis of the collected data.

Results: Levels of renal artery origin ranged from T12 to L2-L3. The most prevalent level of origin was the L1 level, where the left and right major renal arteries started in 51.87% (n=166) and 60% (n=192) of the patients, respectively. L1-2 came next, where L1-L2 was the origin of the left and right major renal arteries for 26.87% (n=86) and 21.87% (n=70) of the subjects, respectively. Gender distribution trends were similar for men and women.

Conclusion: The present study comes to the conclusion that understanding renal vascular variation is critical for clinical practice since it enables surgeons and radiologists to treat patients more effectively.

Keywords: perihilar branching, renal vein, aberrant renal artery, auxiliary renal artery, and variation.

INTRODUCTION

Changes in the renal veins and arteries must be anticipated by urologists. It is important to evaluate and understand these variations before surgery, particularly when nephrectomy is a part of kidney donation and laparoscopic procedures. One The majority of the numerous research projects that have been carried out and documented in the literature are retrospective studies on males and females of various genders with diverse sample sizes.

The research on these renal variations studied across big data sets is lacking in Indian data. Current research on the Indian population does not take gender relationships between males and females into account individually.

Nonetheless, comparable results for Indian men and women from other nations may be found in the literature. The purpose of the current study was to determine the prevalence of renal vascular variation, the distribution of genders, and any possible relationships between variables in patients receiving contrast-enhanced computed tomography (CECT).

MATERIAL AND METHODS

The current prospective clinical investigation aimed to determine the prevalence of renal vascular variation, the gender distribution of patients receiving contrast-enhanced computed tomography (CECT), and any possible correlations between the variables.

After being fully told about the study's design, each participant gave their informed permission. There were 160 males and 160 females among the 320 participants in this study. They were referred to the Department of Radiodiagnosis at the Institute for CECT (Contrast-Enhanced Computed Tomography), where the venous and arterial phases of the scan were evaluated. The renal venous and arterial changes in these individuals were evaluated.

Subjects were between the ages of 18 and 65, willing to take part in the experiment, and recommended for CECT in order to be included in the study. The study excluded participants having a history of renal disease, aberrant renal architecture or vasculature, ectopic kidney position, a history of nephrectomy as the donor, and renal transplant patients.

After study participants were finally included based on inclusion and exclusion criteria, CECT was carried out with one piece of equipment and one trained practitioner. An 18-gauge cannula was inserted into the antecubital vein, and the venous and arterial phases lasted 45 and 6 seconds, respectively.

AbRA is a subtype of AdRA that travels through the primary renal artery, aorta, or branches of the abdominal aorta to reach the kidney at the poles. The AdRA provides nourishment to the kidney in addition to the main renal artery. A form of AdRA called AcRA starts in the aorta and travels via the hilum to the kidney. A bifurcation within 1 cm of the right edge of the inferior vena cava, or retrovacal bifurcation as assessed for the right renal artery, is known as PHB (prehilar branching). For the left renal artery, prihilar branching is the bifurcation of the left renal artery observed 1.5 cm distal to its origin. Since both PHB and re-AbRA come from the principal renal artery, it's important to distinguish between the two. PHB enters the kidney at the hilum, whereas Re-AbRA enters at the pole, suggesting that their entrance sites are distinct.

The renal vein variation studied in this study was known as the late confluence of the renal vein, which is the confluence of the right and left sides of the vein as observed within 1.5 cm of the aorta on the left and 1.5 cm of the inferior vena cava on the right. Several renal veins, the left renal vein's circumaortic route, and the left renal vein's retroaortic course were among the other renal vein variants found.

The CECT pictures for the venous and arterial phases were analyzed by two radiologists with expertise in the field utilizing a VR (volume rendering) viewer, MPR (multiplanar reconstruction), and MIP (maximum intensity projection). The conclusions were accepted.

The current study examined the following variables associated with changes in renal arteries: the level of the major renal artery, the quantity of AbRA, AcRA, and AdRA on both sides, and PHB on both sides. The quantity of veins on each side was one metric used to evaluate renal veins.

SPSS software version 21 (Chicago, IL, USA) was used for statistical analysis of the gathered data, and the t-test and one-way ANOVA were used to formulate the results. The information was shown as means, standard deviations, numbers, and percentages. A significant threshold of $p < 0.05$ was established.

The purpose of the current prospective clinical investigation was to determine whether renal vascular variation is common in patients receiving contrast-enhanced computed tomography (CECT), examine participant gender distribution, and determine whether these parameters are connected. In all, 320 individuals—160 men and 160 women—were used as research samples for this study. They were sent to the Department of Radiodiagnosis at the Institute for CECT for evaluations of the venous and arterial phases. These individuals' renal venous and arterial alterations were assessed. The average age of the research participants was 42.4±2.2 years.

The evaluation of total renal and arterial variations (Figure 1) revealed that 20.93% (n=67) of study participants exhibited venous variations, whereas 16.25% (n=26) were female and 25% (n=80) were male. Arterial anomalies were present in 55.93% (n=179) of the research subjects, who were split into 56.87% (n=91) males and 56.25% (n=90) females (Table 1).

The origin levels of the patients' left and right renal arteries were also examined in this investigation. The origin levels varied from T12 to L2-L3, according to the data. The most frequent level of origin was the L1 level, where the left and right main renal arteries started in 51.87% (n=166) and 60% (n=192), respectively.

In 26.87% of cases, the left and right main renal arteries started at L1-2. The renal artery origin levels ranged from T12 to L2-L3, according to the data. The most frequent level of origin was the L1 level, where the left and right major renal arteries started in 51.87% (n=166) and 60% (n=192) of patients, respectively. L1-2 came next, where L1-L2 was the origin of the left and right major renal arteries for 26.87% (n=86) and 21.87% (n=70) of the subjects, respectively. Men and women exhibited comparable distribution patterns by gender (Table 2).

The prevalence of having extra arteries was higher in women than in men, with 36.25% (n=58) and 6.87% (n=11) having one or more AdRA, respectively. There was a statistically significant difference (p>0.05).

According to the study, 25.91% (n=83) of patients had unilateral AcRA, whereas 1.87% (n=6) had bilateral AcRA. According to Table 4, 1.87% (n=3) of males and 1.25% (n=2) of females had bilateral AcRA, whereas 23.75% (n=38) of men and 28.12% (n=45) of women had unilateral AcRA. Statistics showed that these differences were negligible.

DISCUSSION

The purpose of this prospective clinical study was to investigate the prevalence of renal vascular variation, the gender distribution of patients receiving contrast-enhanced computed tomography (CECT), and any possible correlations between the variables.

There were 160 men and 160 women among the 320 participants in this study. For venous and arterial phase assessments, they were sent to the Department of Radiodiagnosis at the Institute for CECT. The renal venous and arterial changes in these individuals were evaluated. The average age of the research participants was 42.4±2.2 years. 20.93% (n=67) of the research participants had venous changes, with 25% (n=80) being male and 16.25% (n=26) being female, according to an analysis of the total renal and arterial variations. Arterial anomalies affected 55.93% (n=179) of the research participants, who were split into 56.87% (n=91) males and 56.25% (n=90) women. These results aligned with those of Gumus H et al5 (2012) and Raman SS et al4 (2007), who discovered similar rates of arterial and venous alterations in the kidney.

Additionally, research participants' left and right renal artery origin levels were examined. Renal artery origin levels ranged from T12 to L2-L3, according to the findings. The most frequent level of origin was the L1 level, where the left and right major renal arteries began in 51.87% (n=166) and 60% (n=192) of the individuals, respectively. L1-2 came next, where L1-L2 was the origin of the left and right major renal arteries for 26.87% (n=86) and 21.87% (n=70) of the subjects, respectively.

Gender distribution trends were similar for men and women. These findings corroborated those of Koc Z et al. (2006) and Kim JK et al. (2003), who discovered a comparable origin level predominance in their research subjects. According to the prehilar branching variations described in this investigation, bilateral PHB was present in 3.12% (n=5) of the male study participants and 3.75% (n=6) of the female study participants. (p>0.05) This was statistically significant. In addition, the incidence of right prehilar branching was higher in males (11.87%; n = 19) than in women (6.87%; n = 11).

This difference was likewise statistically significant, with p>0.05. These results were in line with earlier research that found PHB on CECT in the renal vasculature, which was reported in 2001 by Rydberg J et al. and in 2010 by Ugurel M et al. AdRA showed that compared to men, women were more likely to have extra arteries.

No subjects having more than four AdRA were listed. The prevalence of having extra arteries was higher in women than in men, with 36.25% (n=58) and 6.87% (n=11) having one or more AdRA, respectively. There was a statistically significant difference (p>0.05). According to the study, 25.91% (n=83) of patients had unilateral AcRA, whereas 1.87% (n=6) had bilateral AcRA. While bilateral AcRA was found in 1.87% (n=3) of the males and 1.25% (n=2) of the females, unilateral AcRA was found in 23.75% (n=38) of the males and 28.12% (n=45) of the females.

Statistics showed that these differences were negligible. The results of the authors' studies on AcRA and AdRA, which were published by Famurewa O et al. in 2018 and Ozkan U et al. in 2006, were consistent with this.

CONCLUSION

Within the bounds of its limitations, the current study suggests that radiologists and urologists need to be aware of and knowledgeable about variations in the renal vasculature, and that CECT is a valid radiologic technique for evaluating these variations. A few drawbacks of the current study were, nonetheless, a limited sample size, a brief monitoring period, and biases related to geographic areas. Therefore, further long-term research with bigger sample sizes and longer observation periods will aid in coming to a conclusive result.

REFERENCES

1. Rao TR. Aberrant renal arteries and its clinical significance: a case report. Int J Anat Var. 2011;4:37-9.
2. Al-Katib S, Shetty M, Jafri SMA, Jafri SZH. Radiologic assessment of native renal vasculature: a multimodality review. Radiograph. 2017;37:136-56.

3. Raman SS, Pojchamarnwiputh S, Muangsomboon K, Schulam PG, Gritsch HA, Lu DS. Surgically relevant normal and variant renal parenchymal and vascular anatomy in preoperative 16- MDCT evaluation of potential laparoscopic renal donors. JR Am J. Roentgenol. 2007;188:105-14.
4. Kang W, Sung DJ, Park B, Kim MJ, Han NY, Cho SB, et al. Perihilar branching patterns of the renal artery and extrarenal length of arterial branches and tumor-feeding arteries on multidetector CT angiography. Br J Radiol. 2013;86:20120387.
5. Gümüş H, Bükte Y, Özdemir E, Çetinçakmak MG, Tekbaş G, Ekici F, et al. Variations of renal artery in 820 patients using 64-detector CT-angiography. Renal Failure. 2012;34:286-90.
6. Koc Z, Ulusan S, Oguzkurt L, Tokmak N. Venous variants and anomalies on routine abdominal multi-detector row CT. Eur J Radiol. 2007;61:267-78.
7. Kim J-K, Park S-Y, Kim H-j, Kim C-S, Ahn H-J, Ahn T-Y, et al. Living donor kidneys: usefulness of multidetector-row CT for comprehensive evaluation. Radiology. 2003;229:869-76.
8. Rydberg J, Kopecky KK, Tann M, Persohn SA, Leapman SB, Filo RS, et al. Evaluation of prospective living renal donors for laparoscopic nephrectomy with multisection CT: the marriage of minimally invasive imaging with minimally invasive surgery. Radiographics. 2001;21:223-36.
9. Ugurel M, Battal B, Bozlar U, Nural M, Tasar M, Ors F, et al. Anatomical variations of the hepatic arterial system, coeliac trunk, and renal arteries: an analysis with multidetector CT angiography. Br J Radiol. 2010;83:661-7.
10. Özkan U, Oguzkurt L, Tercan F, Kizilkilic O, Koç Z, Koca N. Renal artery origins and variations: angiographic evaluation of 855 consecutive patients. Diagnostic and interventional Radiology. 2006;12:183.
11. Famurewa O, Asaleye C, Ibitoye B, Ayoola O, Aderibigbe A, Badmus T. Variations of renal vascular anatomy in a Nigerian population: A computerised tomography study. Niger J Clin Pract. 2018;21:840-6.

TABLES

S. No	Variations	Total % (n=320)	Males % (n=160)	Females % (n=160)
1.	**Venous variations**	20.93 (67)	25 (80)	16.25 (26)
2.	**Arterial variations**	55.93 (179)	56.87 (91)	56.25 (90)

Table 1: Prevalence of venous and arterial variations in the study subjects

S. No	Level of Spine	Left main renal artery			Right main renal artery		
		Total % (n=320)	Female % (n=160)	Male % (n=160)	Total % (n=320)	Female % (n=160)	Male % (n=160)
1.	**L1**	51.87 (166)	1.87 (3)	1.25 (2)	60 (192)	61.87 (99)	58.75 (94)
2.	**L1-2**	26.87 (86)	8.12 (13)	5 (8)	21.87 (70)	20 (32)	21.87 (35)
3.	**L2**	11.87 (38)	58.75 (94)	45 (72)	10.93 (35)	10 (16)	11.25 (18)
4.	**L2-3**	0.93 (3)	21.87 (35)	31.87 (51)	0.93 (3)	1.25 (2)	1.25 (2)
5.	**T12**	1.87 (6)	8.75 (14)	16.25 (26)	1.87 (6)	1.25 (2(	1.87 (3)
6.	**T12-L1**	6.87 (22)	0	1.25 (2)	5.93 (19)	6.87 (11)	5 (8)

Table 2: Origin level of the left and right main renal artery in the study subjects

S. No	PHB variation	% (n)
1.	**Unilateral PHB**	
a)	**Total (n=320)**	15 (48)
i.	Right	10 (32)
ii.	Left	5.93 (19)
b)	**Males** (n=160)	20 (32)
i.	Right	11.87 (19)
ii.	Left	8.12 (13)

c)	**Females** (n=160)	11.25 (18)
i.	Right	6.87 (11)
ii.	Left	3.75 (6)
2.	**Bilateral PHB**	
a)	Total (n=320)	3.12 (10)
b)	Males (n=160)	3.12 (5)
c)	Females (n=160)	3.75 (6)

Table 3: Presence of Prehilar branching in the study subjects

S. No	PHB variation	% (n)
1.	**One AdRA**	
a)	Total	41.87 (134)
b)	Male	36.25 (58)
c)	Female	26.87 (43)
2.	**Two AdRA**	
a)	Total	5.93 (19)
b)	Male	6.87 (11)
c)	Female	3.75 (6)
3.	**Three AdRA**	
a)	Total	0.93 (3)
b)	Male	1.25 (2)
c)	Female	1.25 (2)
4.	**Four AdRA**	
a)	Total	0.93 (1)
b)	Male	1.25 (2)
c)	Female	1.25 (2)
5.	**Unilateral AcRA**	
a)	Total	25.91 (83)
b)	Male	23.75 (38)
c)	Female	28.12 (45)
6.	**Bilateral AcRA**	
a)	Total	1.87 (6)
b)	Male	1.87 (3)
c)	Female	1.25 (2)

Table 4: Prevalence of AdRA and AcRA branching in the study subjects