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Original Article

Frequencies of accessory renal arteries in 129 Iranian patients

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Abstract: Introduction: Anatomical variation of accessory renal artery has a great clinical importance especially in surgical operations. This issue might bring different complications during surgeries. The prevalence of these variations have been reported differently among populations. Here in this paper, we aimed to have a study on frequencies of anatomical variation of renal arteries. Methods: This cross-sectional study was performed on 129 patients who were referred to Imam Khomeini hospital-Tehran in order to perform multislice computed tomography angiography using multiple detector computed tomography (MDCT) of kidneys in 2018-2019. Data were assessed by expert radiologists regarding to renal arteries, characteristics of both side arteries, number of accessory arteries and locations of these arteries based on patient's gender. Results: Here we reported at least one accessory artery in 15.5 percent of right and 17.1 percent of left kidneys. The diameter of left accessory artery was in 14.3 percent of cases equal to the main artery and in 85.7 percent of cases, smaller. We also showed that all of the right accessory arteries were smaller than the main renal artery. We indicated no significant difference between frequencies of total arteries of right and left kidneys. Conclusion: There was a large variety of renal accessory arteries with high frequency among our study population. This issue has a great surgical importance especially for urologists and we suggest further studies on larger populations should be performed in order to assess frequency of accessory renal artery in Iranian population.

Keywords: Renal artery, accessory artery, anatomical variation, computed tomography angiography

Introduction

Kidneys are accounted as important organs of our body performing different tasks. Development of kidneys during embryonic phase begins from inside the pelvis which continues while ascending [1]. As a result, kidneys might be vascularized by different arteries [2]. Common iliac artery is known to be the first responsible artery for renal perfusion when kidneys located still inside pelvis. When ascending, kidneys will be vascularized by lower end of aorta and after they locate at the final anatomical place, they will be vascularized by so called renal arteries originated directly from aorta [3]. Renal arteries are two great vessels originated from aorta in the levels of lumbar vertebrae (L1-L3) below the superior mesenteric arteries. As a result, there are vast variety of anatomies for arteries which vascularize kidneys [4]. This variety is reported to be more often than any other arteries in body which put a great emphasis on our knowledge of them. Beside morphological varieties, differences in number of renal arteries especially dual renal arteries are the most common detected variety [5].

On the other hand, accessory renal arteries are also very common which mostly originate from aorta [6]. There have been also some reports of cases in which these accessory arteries had been originated from common iliac artery or superior of inferior mesenteric arteries [7]. Different clinical importance of accessory arteries have been reported. Accessory arteries vascularize a part of kidney and if any injury occurs, kidneys might be threatened with ischemia. The other importance of these arteries is due to kidney transplantation. Previous studies have indicated that kidney transplantation is performed

easier and with least post operation complications in those kidneys which are vascularized by only one single artery [8, 9]. The risks of transplantation rejection is also reported lower in patients with single kidney artery. Presentation of accessory renal arteries was also one of the relative contra indications of kidney transplantation for many years [10]. Other clinical importance of accessory renal arteries is changes in size of other vessels such as testicular arteries, supra renal or accessory phrenic arteries due to accessory renal arteries [11]. Studies have also reported that anatomical variations in accessory renal arteries might be associated with atherosclerosis, increased blood pressure, arterial thrombosis, renal artery stenosis, parenchymal necrosis and post transplantation bleeding [12, 13].

Satyapal and colleagues believed that the prevalence of accessory renal arteries are different among populations and are related to their race. They reported a prevalence rate of 32.1 percent in men and 20.2 percent in women. Furthermore, they reported that presence of one and two accessory renal arteries are respectively 31.1 and 5.4 in African population, 13.5 and 4.5 in Indian population, 30.9 and 4.4 in white race and 18.5 and 0 in other races. They indicated that the presence of left accessory artery is more common than right accessory artery [14].

It should also be noted that arteries related to superior segments of the kidneys have the most varieties regarding to their origin, number and vascularization area. As a result, surgeries of superior segments of kidneys are encountered with most danger even threatening life of patients. So, expanding our knowledge of the accessory renal arteries and their anatomical variations is one of the important basis of diagnosis and treatment of renal diseases. This issue has also special importance for transplantation surgeries, arterial surgeries and treatments of renal injuries due to trauma in order to reduce complications. Regarding to different reported prevalence rate and variations of accessory renal arteries in different populations and importance of this issue, here we aimed to have a survey on the patients referred to Imam Khomeini hospital-Tehran undergoing abdominal computed tomography (CT) scan.

Methods and material

This cross-sectional study was performed on 129 patients in 2018-2019. This study was approved in ethical committee of Tehran University of Medical Sciences and the research committee of Tehran University of Medical Sciences confirmed it. Our study population were selected from patients who were referred to Imam Khomeini hospital in Tehran in order to perform renal angiography or abdominal multiple detector computed tomography (MDCT), age more than 18 years and also singing the informed consent were our other inclusion criteria. Our exclusion criteria were having a history of surgery on kidneys, having severe skeletal anomalies low qualities of images and patient's refusal. All images were reviewed by expert radiologists and data regarding to both renal arteries, characteristics of both side arteries, number of accessory arteries and locations of these arteries based on patient's gender. Data were then analyzed using SPSS software.

Results

In the present study, 129 patients were included and evaluated. 68 patients (52.7%) were male and 61 (47.3%) were female. Mean age of patients was 53.3±19.0 years. We indicated that there was at least one in 15.5% of right kidneys and in 17.1% of left kidneys. The diameter of left accessory artery was in 14.3 percent of cases equal to the main artery and in 85.7 percent of cases smaller than the main renal artery. We also showed that all of the right accessory arteries were smaller than the main renal artery. Our analysis indicated that there were no significant difference between total main arteries and accessory arteries in right and left kidneys in both male and female patients (P=0.48 and P=0.29 for right and left kidneys, respectively). There were also no significant difference between left and right kidneys regarding to number of total and accessory renal arteries (P=0.43). These data are summarized in **Table 1**. Number of accessory renal arteries in both right and left kidneys were not significantly different in males and females (P=0.48 and P=0.26 for right and left kidneys, respectively). There were no significant difference between left and right kidneys regarding to number of accessory renal arteries

Table 1. Total number of left and right accessory renal arteries in male and female patients

Side	Number of arteries	Males: number (%)	Females: number (%)	Total: number (%)	*P*-value*
Right	1	56 (82.4)	53 (86.9)	109 (84.5)	0.48
	2	12 (17.6)	8 (13.1)	20 (15.5)	
	3	0	0	0	
Left	1	54 (79.4)	53 (86.9)	107 (82.9)	0.29
	2	13 (19.1)	6 (9.86)	19 (14.8)	
	3	1 (1.5)	2 (3.32)	3 (3.3)	
P-value**		-	-	0.43	

*: using Mann-Whitney analysis. **: using Wilcoxon analysis.

Table 2. Number of left or right accessory renal artery in male and female patients

Side	Presence of accessory renal artery	Males: number (%)	Females: number (%)	Total: number (%)	*P*-value*
Right	Yes	12 (17.6)	8 (13.1)	20 (15.5)	0.48
	No	56 (82.4)	53 (86.9)	109 (84.5)	
Left	Yes	14 (20.6)	8 (13.1)	22 (17.1)	0.26
	No	54 (79.4)	53 (86.9)	107 (82.9)	
P-value**		-	-	0.86	

*: using X^2 analysis. **: using McNemar analysis.

Table 3. Comparison of the diameter of accessory renal artery with main renal artery

Side	Diameter of AA compared to MA	Males: number (%)	Females: number (%)	Total: number (%)	*P*-value*
Right	Smaller	12 (100)	8 (100)	20 (100)	>0.99
	Same	0	0	0	
Left	Smaller	12 (85.7)	8 (100)	20 (90.9)	0.62
	Same	2 (14.3)	0	2 (9.12)	

AA: accessory artery, MA: main artery. *: using Mann-Whitney analysis.

Table 4. Location of accessory renal artery compared to main renal artery

Side	Location of AA compared to MA	Males: number (%)	Females: number (%)	Total: number (%)	*P*-value*
Right	Lower	5 (41.7)	1 (12.5)	6 (30.0)	0.62
	Same level	0	2 (25.0)	2 (10.0)	
	Upper	7 (58.3)	5 (62.5)	12 (60.0)	
Left	Lower	7 (50.0)	4 (50.0)	11 (50.0)	>0.99
	Same level	7 (50.0)	4 (50.0)	11 (50.0)	
	Upper	0	0	0	
P-value**		-	-	0.32	

AA: accessory artery, MA: main artery. *: using Mann-Whitney analysis. **: using Wilcoxon analysis.

(P=0.86). **Table 2** reveals these information. Further analysis also showed no significant difference between male and female patients regarding to comparison of diameter of accessory renal artery and main renal artery in both right (P>0.99) and left (P=0.62) kidneys. Data regarding to this comparison is summarized in **Table 3**. Data regarding to location of accessory renal artery (lower, at the same level and higher) compared to main renal artery were also analyzed showing no significant difference between male and female patients

in right (P=0.62) and left (P>0.99) kidneys and also between two kidneys (P=0.32). (**Table 4**).

Discussion

In the present study, we showed that the prevalence of accessory renal artery is 15.5% in right kidneys and 17.1% in left kidneys. There were also no significant difference between frequencies of total arteries and accessory arteries of right and left kidneys between male and female patients. Nowadays, along with the growing trend of kidney transplantation and its benefits compared to hemodialysis, recognizing anatomical characteristics and variations of renal arteries especially in organ donors has a great importance. This issue could be assessed from renal artery angiography [15, 16]. Although, renal artery angiography is still a gold technique in assessing arterial anatomies but MDCT has been accounted as a functional method with fewer complications and easier performance technique than angiography. MDCT could also provide sharper images with more details in order to study normal anatomy and also variations [17].

Presence of accessory renal arteries is known to be a normal variation with different prevalence rate in different populations. Satyapal and others had a study on 130 organ donors for kidney transplantation and 74 corps in African population and reported that mean prevalence of accessory renal artery is 27.7%. The reported prevalence rate for right kidney was 18.6% and for left kidney was 27.6% [14]. In another report by Meyers and colleagues, they showed that the prevalence of accessory renal artery is 29.3% among American population [18]. Furthermore, Singh and others reported a prevalence rate of 30-35% for renal accessory artery in patients in Singapore [19]. These data are somehow different from results of our study and this might be due to differences of prevalence rate among different populations or also because of variations in study population. We reported a lower prevalence rate among our study population compared to other studies. We also showed that despite what previous studies reported, there was no significant difference between females and males. In another study by Kadir and others, they showed that the prevalence of accessory renal artery is 15% in normal population and also they reported equal prevalence rate for left and right accessory arteries and indicated 12% prevalence rate for both sided accessory renal arteries [20]. These results are in line with the results of our study. Another important point of this study was assessing diameter of accessory renal artery. We showed that in 14.3% of left accessory renal arteries had an equal diameter to main renal artery and while on the other hand, all of the right accessory arteries had a smaller diameter. This issue is also not in line with previous studies which had been performed in other populations.

Taken together, regarding to our results and results related to previous studies, we can suggest that assessing renal arteries using imaging modalities such as abdominal MDCT should be administered before operations and surgeries on kidneys due to anatomical variations. Although we reported a lower prevalence rate for accessory renal arteries in our study population, but more studies on larger populations seem to be required.

Conclusion

Variations in accessory renal arteries are differently prevalent among populations and this issue seem to have surgical importance. Our results along with the results of previous studies put emphasis on variable rate of frequencies of accessory renal arteries. We also suggest that more studies on larger populations should be performed in order to assess this frequency rate in Iranian population. We also recommend imaging assessments should be performed for patients who are candidates of kidney surgeries.

Disclosure of conflict of interest

None.

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