Frequency of Acccessory Renal Arteries Diagnosed by Computerized Tomography

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ABSTRACT

Introduction: Accessory renal arteries play a significant role in kidney and abdominal aorta surgery, and renovascular hypertension. In the published literature, the frequency varies considerably, depending on the size of the sample, the method of examination and the ethnic group. **Materials and Methods:** The aim of this study is to determine the general frequency of accessory renal arteries, their frequency in relation to gender, the origin and the vascularization area, and to determine the differences in left-right and bilateral distribution. **Results and Discussion:** CT scans of 1357 patients were retrospectively analyzed. Accessory renal arteries were recorded in 35.5% of patients, with a statistically significant difference in male and female incidence ($p<0.05$) with a ratio of 1.4 : 1. Accessory arteries occur more commonly unilaterally ($p<0.05$) than bilaterally with a ratio of 4 : 1. Unilateral accessory renal arteries occur at approximately the same frequency at right and left side 1.1 : 1, without statistically significant differences in frequencies ($p>0.05$). Of the total number of noticed accessory renal arteries 76.7% was originated from abdominal aorta (AA), 23% from renal artery and 0.3% from CIA, with a ratio of 3.3: 1 : 0.0005. **Conclusions:** The study showed a relatively high frequency of accessory arteries and described their anatomy in detail, which can be of great importance in surgical interventions on abdominal aorta, kidneys, and in case of kidney transplantation.

Keywords: Accessory, Renal, Arteries, CT.

1. INTRODUCTION

Accessory renal arteries are the most common anatomic variation in kidney vascularization, which is of particular importance in kidney and abdominal aorta surgery as well as in endovascular procedures (1).

The significance of accessory renal arteries in renovascular hypertension is difficult to determine because atherosclerosis most commonly affect all renal arteries, which requires a large sample of angiographic examinations in order to make valid conclusions (2).

Accessory renal arteries can originate from abdominal aorta, the renal arteries and some of the branches of the abdominal aorta. Frequency in the general population differs depending on the research method, the sample size and the ethnic group which the study covered, and the results differ significantly. Incidence varies from 24% in Turkey (3) to 51% in India (4). In a sample of 39 cadavers, researchers from the Department of Anatomy at the Faculty of Medicine of the University of Sarajevo described accessory renal arteries in 46.15% of cases (5), while the researchers using the same method in India described the accessory renal arteries in 24.9% of cases (6).

The goal of this study was to determine the frequency of accessory renal arteries on a sample of 1357 patients, by CT examination performed at the Clinic of Radiology, Clinical Center of Sarajevo University, Bosnia and Herzegovina.

2. MATERIAL AND METHODS

CT scans were retrospectively evaluated from January 1, 2014 to June 30, 2014. Study included patients with CT scan of the abdomen with arterial phase, regardless of the indications, using 16 and 64 slices CT scans. The criteria for exclusion from the study include repeated examinations, technically unsatisfactory arterial phase, total nephrectomy, kidney tumors, kidney anomalies, terminal stage renal insufficiency, and other pathological conditions that complicates evaluation.

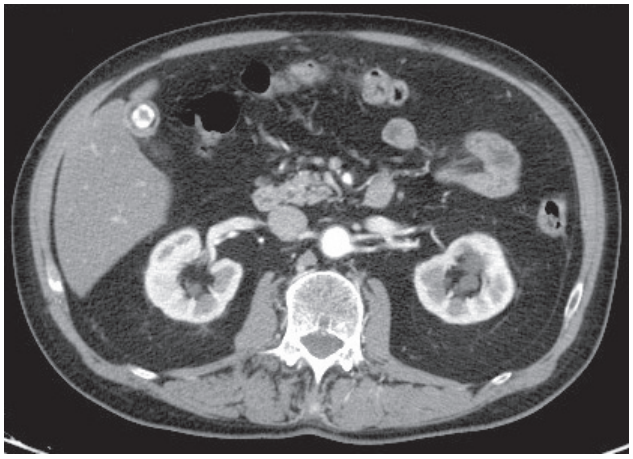

Figure 1. Accessory renal artery for left kidney marked by a red arrow (axial scan).

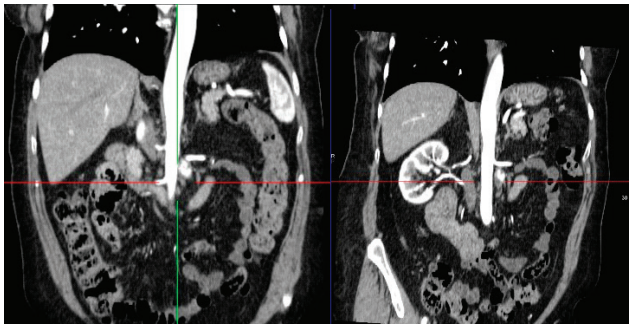

Figure 2. Two coronary scans of the same patient show the origin (left scan) and the final part of the descental accessory renal artery (right scan). The accessory arteries are marked with red arrows.

All CT scans were reviewed on two occasions by two different examiners. The findings of accessory renal arteries as well as their anatomy are described in detail and documented.

3. RESULTS

The study included 1357 patients, of whom 700 (51.5%) male and 657 (48.5%) females. Accessory renal arteries (Figures 1, 2, 3) were recorded in 482 (35.5%) patients. The incidence of accessory renal arteries in men was 41.2% (289/700), while in women 29.4% (193/657). Unilateral accessory renal arteries were noted in 80.7% (389/482) patients, while the bilateral distribution was registered at 19.3% (93/482) of patients.

Not counting patients with bilateral distribution, 52.7% (205/389) of patients had an accessory renal artery on the right and 47.3% (184/389) on the left side (Table 1).

	Number of patients examined	Patients with accessory arteries	Patients with unilateral arteries	Unilateral right	Unilateral left	Patients with bilateral arteries
Men	700	289	225	116	109	64
Women	657	193	164	89	75	29
Total	1357	482	389	205	184	93

Table 1. Unilateral and bilateral distribution in relation to patient's gender.

	Number of bilateral accessory arteries	Arteries originating from abdominal aorta	Arteries originating from renal artery	Arteries for the upper half	Arteries for the lower half	Arteries for hilus
Right	97	71	26	38	9	50
Left	96	74	22	33	5	58
Total	193	145	48	71	14	108

Table.2. Distribution of bilateral accessory arteries by origin and part of organ that vascularize.

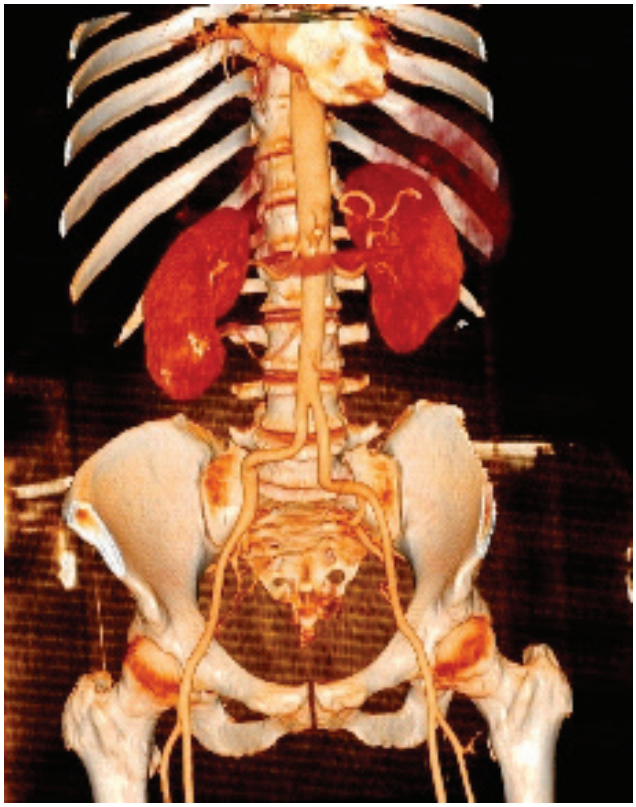

Figure 3. The SSD reconstruction shows the accessory renal artery to the right (arrow).

From the group of patients with unilateral accessory arteries, 2 patients had two accessory renal arteries on the right and 2 patients two accessory arteries on the left.

Bilateral accessory renal arteries were noticed at 6.9% (93/1357) of the total examined sample. From baseline 19.3% (93/482) of the patient from the group with the noted accessory arteries, of which 68.8% (64/93) of male and 31.2% (29/93) of female gender had bilateral accessory renal arteries. In this group of patients, a total of 193 accessory renal arteries were noted because three patients had two accessory renal arteries on the left side and two patients had three accessory renal arteries on the right (Table 2).

A total of 586 accessory arteries were observed in the examined patients, out of which 76.7% (449/586) originating from abdominal aorta, 23.0% (135/586) from renal arteries, and two (0.3%) originated from common iliac arteries, from which one for the lower right kidney and the other for the

	Accessory artery from AA	Accessory artery from renal artery	Accessory artery from AIC	Arteries for the upper half	Arteries for the lower half	Arteries for hilus
Men	175	51	2	65	24	138
Women	129	36	0	44	22	100
Total	304	87	2	109	46	238

Table 3. Distribution of accessory renal arteries by site of origin and part of organ that they vascularize.

	Accessory artery from AA	Accessory artery from renal artery	Accessory artery from AIC	Arteries for the upper half	Arteries for the lower half	Arteries for hilus
Right	142	63	1	73	25	108
Left	162	24	1	36	21	130
Total	304	87	2	109	46	238

Table 4. Distribution in relation to side of the body, taking into account the origin and part of organ that they vascularize.

lower half of the left kidney.

In Table 3 the distribution of accessory renal arteries is presented by the site of origin and part of the organ that they vascularize in relation to patient's gender, in table 4 in relation to size of the body, with the exception of the bilateral accessory arteries whose distribution is separately described.

4. DISCUSSION

The incidence of accessory renal arteries on the examined sample is 35.5%, with a statistically significant difference in incidence among male and female patients ($p<0.05$) with a ratio of 1.4 : 1. Accessory arteries occur more commonly unilaterally ($p<0$, 05) compared to a bilateral arteries, with a ratio of 4 : 1. Furthermore, there is a statistically significant difference in the individual distribution of unilateral ($p<0.05$) and bilateral ($p<0.05$) accessory arteries between men and women with a ratio of 1.3 : 1 for unilateral and 2 : 1 for bilateral accessory arteries.

Unilateral accessory renal arteries occur at approximately the same frequency between right and left side of the body 1.1 : 1, without statistically significant differences in frequencies ($p>0.05$).

Of the total number of noted accessory renal arteries 76.7% had origin from abdominal aorta, 23% from renal artery and 0.3% from CIA, with a ratio of 3.3 : 1 : 0.0005. Unilateral accessory arteries of abdominal aorta origin occur more often in males ($p<0.05$), with a ratio of 1.3 : 1, while such difference between the genders is not recorded when it comes to accessory arteries of renal artery origin.

The unilateral accessory arteries of the abdominal aorta origin are approximately equally represented between the left and the right side of the body, while the accessory arteries of the renal artery origin are much more frequents at the right side ($p<0.05$) with a ratio of 2.7 : 1.

5. CONCLUSION

The study confirmed the relatively high frequency of accessory renal arteries in the general population, which can be of great importance in pathology and kidney transplantation, as well as in endovascular and surgical care of abdominal aorta aneurysms. Evaluation of CT scans was performed on a sample of 1357 patients, which is the largest sample in a published literature (7). A detailed description of the distribution of accessory renal arteries between the male and female gender, as well as their presence between the left and right side of the body, and the frequency of unilateral and bilateral occurrence of accessory arteries is presented. The study provides enough data for even more detailed statistical analysis, especially when it comes to the origin of accessory renal arteries and parts of the kidneys that they vascularize.

- Conflict of interest: none declared.
- Authors contribution: Prevljak S has designed the study, methodology and research framework. Prelevic E, Mesic S, Odey A and Kristic S collected data, Prelevic E wrote the text and performed statistical data analysis, Vegar-Zubovic S provided useful suggestions throughout the process.

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