



MORPHOLOGY AND TOPOGRAPHY OF THE RENAL ARTERIES IN THE MELANODERM LIVING IN BENIN

Laleye Christel Marie ^{1,2}, Videgla Boris Landry Enagnon ^{1,3}, Sogan Ananivi¹, Hadonou Ayaovi Armel¹, Hounton Saturnin Emmanuel Dèdonou ^{1,3}, Biaou Olivier ³, Mehinto Delphin Kuassi ², Hounnou Martial Gervais ¹, Agossou - Voyeme Augustin karl ¹.

¹Human Anatomy Laboratory (LAH), Faculty of Health Sciences (FSS).

²University Clinic of Visceral Surgery, University Hospital Center - Hubert Koutoukou Maga (CNHU-HKM) of Cotonou.

³Medical Imaging Department, University Hospital Center - Hubert Koutoukou Maga (CNHU-HKM) in Cotonou.

ABSTRACT

Renal artery variations may relate to the origin, course, and end branches of renal artery divisions. To describe the morphology and topography of renal arteries in melanoderm living in Benin.

This was a retrospective study from March 1, 2016 to April 31, 2017, i.e. 14 months. The study population consisted of all injected abdominal CT scans clearly highlighting the renal artery and its branches from the CT scan unit of CNHU-HKM. The data collected was entered into CSpPro 6.2 software and then processed and analyzed using stata 13 software. The right renal arteries originated in an antero-lateral position on the aorta in 84.4% of cases, while those left in a medio-lateral position in 45.9% of cases. They were projected mainly opposite L1 on the right and L2 on the left. Regarding their courses, all the arteries studied were concave posteriorly in the transverse plane and mostly concave above and upwards. Finally, the renal arteries mostly end by bifurcating into anterior and posterior branches in 88.5% of cases, by trifurcating in 1.5% of cases, rarely they divide into 4 branches. The renal arteries arise on the right in an antero-lateral position on the aorta and on the left in a medio-lateral position. They are lower located on the left with a concave path backwards and upwards then head upwards. Finally, they end by bifurcating. This knowledge is essential for patricians working on the kidneys.

Key words: renal arteries, morpho-topography, melanoderm, Benin, scanner, origin, termination, path.

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INTRODUCTION

Renal artery variations are common in the general population with social, ethnic and racial differences [Kadir S., 1991; Boijesen E., 1997]. Indeed, they are more widespread among Africans (37%) and Caucasians (35%), than among Hindus (17%). The extra-renal branches generally show a variability of 9% to 76% [Kadir S., 1991; Khamanarong K et al., 2004]. All these variations relate to the number, the origin, the course and the terminal branches of divisions of the renal arteries [Garcier JM et al., 2001; Ogeng'ó JA et al., 2010; Saldarriaga B et al., 2008].

Depending on the number, multiple accessory and polar arteries have been demonstrated in the literature [Chai JW et al., 2008]. The need to know the position of the renal artery on the aorta appeared with

the practice of interventional arteriography for dilatations and implantation of stents in the renal arteries [Garcier JM et al., 2001]. The multiplicity of its terminal divisions has led many authors to perform renal segmentation based on arterial division [Johnson et al., 2013]. Other studies have focused on extrarenal segmentation of the renal artery [Sungura R et al., 2018; Budhiraja V et al., 2010; Saldarriaga B et al., 2008; Papaloucas C et al., 2007; Santos-Soares TR et al., 2013; Williams PL et al., 1989; Schmerber Fet al., 1968]. To perform partial nephrectomies, for example, surgeons rely on the extra parenchymal segmentation of the renal artery, they clamp the segmental branch concerned in order to identify the limits of the pathological segment. Embolizations also follow the same

principle, that is to say the obstruction of a segmental branch in order to destroy the segment that it vascularizes.

The objective of this study was to describe the morphology and topography of renal arteries in melanoderms living in Benin.

MATERIALS AND METHODS

This study took place in the scannography unit of the Center National Hospitalier Universitaire Hubert Koutoukou Maga and the human anatomy laboratory of the Faculty of Health Sciences.

This is a descriptive retrospective study. It took place from March 1, 2016 to April 31, 2017. The study population is made up of subjects who have undergone an abdominal CT scan during the study period, including injected abdominal CT scans clearly highlighting the renal artery and its branches. Subjects with renal vascular disease and/or with any other acquired pathologies that could modify the anatomy of the renal artery were not taken into account. The variables relate to the descriptive anatomy of the renal artery, namely the origin, the course, the terminal branches of the renal arteries.

The scanners were read using Radiant software. The CT scans were reconstructed in multiplane with MIP (maximal intensity projection) and in volume rendering as presented to facilitate the analysis of the arterial branches concerned. Measurements were made using dedicated functions of the toolbar on native slices or reconstructions depending on the case.

For emergence on the abdominal aorta, it was defined by dividing the aorta into 4 quadrants by two perpendicular lines, one vertical and the other horizontal, both joining at the center of the aorta. This allowed you to define 3 positions. The arteries originating in front were consecrated in an anterolateral position, Those originating in the midline in a mediolateral position and originating posteriorly in a posterolateral position.

Confidentiality of patient scan results is guaranteed Authorization to access scan results was given by the various directors and/or department heads concerned.



Figure 1: method used to establish the point of emergence of the renal artery

RESULTS

At the end of this study, the renal arteries were originally distributed according to their level of emergence on the abdominal aorta and their vertebral projection. Regarding the position on the abdominal aorta, it was defined in the antero-lateral, medio-lateral and postero-lateral position (fig 2,3,4).

At this level (Table I), it was noted that on the left, the majority of the arteries arise in the medio-lateral position, i.e., 45.9%, followed by the postero-lateral position in 32.6% and antero-lateral in 21.5%. On the

right, the majority of the arteries arise in the antero-lateral position, i.e., 84.4%, followed by the medio-lateral position, i.e., 13.2% and postero-lateral in 2.4%.



Figure 2: Axial section showing the anterolateral position of the origin of the right renal artery on the aorta.



Figure 4: Axial section showing the posterolateral position of the origin of the left renal artery on the aorta



Figure 3: Axial section showing the mediolateral position of the origin of the left renal artery on the aorta.

Table I: Distribution of the origin of the renal artery on the aorta according to laterality

Origin	Laterality	(N)	Percentage
Antero-lateral	Right	141	41.6
	Left	37	10.9
	Subtotal	178	52.5
Medio-lateral	Right	22	6.5
	Left	79	23.3
	Subtotal	101	29.8
Posterolateral	Right	4	1.2
	Left	56	16.5
	Subtotal	60	17.7
Total		339	100

According to the vertebral projection, the renal arteries on the right side projected opposite L1 and L2 on the left. Table II presents the distribution of the vertebral projection of the renal arteries according to laterality.

With regard to the course, it was defined first in the transverse plane where all the renal arteries presented a posterior concavity, then in the frontal plane where the majority of the renal arteries went upwards with a high concavity in a proportion of 39.9% of cases (fig 5).

Table II: Distribution of the vertebral projection of the renal arteries according to laterality

Laterality	Vertebral projection	(N)	Percentage
Right	12 th thoracic vertebra (T12)	2	0.64
	Vertebral disc T12-L1	3	0.96
	1 st lumbar vertebra (L1)	58	18.24
	Vertebral disc L1-L2	40	11.52
	2 nd lumbar vertebra (L2)	58	16.64
	Vertebral disc L2-L3	5	1.60
	4 th lumbar vertebra (L4)	1	
	Subtotal	167	49.60
Left	12 th thoracic vertebra (T12)	2	0.32
	Vertebral disc T12-L1	1	0.32
	1 st lumbar vertebra (L1)	51	16.00
	Vertebral disc L1-L2	43	12.48
	2 nd lumbar vertebra (L2)	59	16.96
	Vertebral disc L2-L3	9	2.24
	3 rd lumbar vertebra (L3)	6	0.32
	5 th lumbar vertebra (L5)	1	0.32
	Subtotal	172	48.96
Total		339	100

Table III: Distribution according to the course of the renal artery

Laterality	Path	N	%	
Right	Straight	19	5.6	
	Oblique upwards	10	2.9	
	Downward slant	46	13.2	
	Concave top and top	53	15.5	
	Concave top and bottom	11	3.2	
	Concave down and down	13	3.8	
	Sinuuous horizontal	1	0.3	
	Winding upwards	2	2.1	
	winding down	8	2.3	
		Subtotal	167	49
	Left	Straight	13	3.8
		Downward slant	5	1.5
		Oblique down	35	10.3
Concave top and top		83	24.3	
Concave top and bottom		8	2.3	
Concave bottom and top		3	0.9	
Concave down and down		8	2.3	
Winding horizontal		1	0.3	
Winding upwards		4	1.3	
winding down		12	3.5	
		Subtotal	172	51
Total			339	100

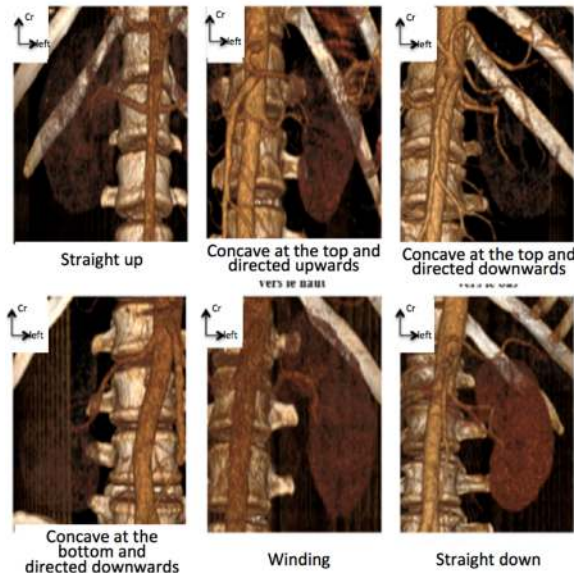


Figure 5: Reconstructions in volume rendering of the different paths of the renal arteries.

DISCUSSION

The need to know the position of the renal artery on the aorta appeared with the practice of interventional radiology under arteriography. The present study found an anterolateral predominance of the birth of the right renal arteries over the aorta, which was also found by Verschuyt et al in the USA [Verschuyt E et al.,1997] and Schönherr et al in Belgium [Schönherr E et al., 2016]. It can be explained anatomically by the right position of the inferior vena cava in relation to the abdominal aorta which would require

The renal arteries end by bifurcating in 88.8% of cases; trifurcating in 1.5% and dividing into 4 branches in 0.3% of cases. Regarding the cases of bifurcations, almost all the arteries divided into an anterior and a posterior branch (88.5%), except in one case where there was a posterior branch and an upper branch (0.3%). For the trifurcations, in 4 (1.2%) cases out of 5 (1.5%) it was anterior, posterior and superior branch. In the last case (0.3%) it was anterior, posterior and inferior branch. for the case of subdivision in 4 branches: anterior, posterior, superior and inferior branches had been found.

an anterior birth of the right renal artery. Schönherr et al in Belgium found that the left renal artery arises mainly in a mediolateral position [Schönherr E et al., 2016] as in the present study, unlike Verschuyt et al in the USA who found a posterolateral predominance [Verschuyt E et al.,1997]. Indeed, the left side of the aorta being free of any obstacle, these arteries can emerge at variable positions.

According to the vertebral projection, the renal arteries generally originate lower on

the left than on the right. As in most of the studies here, L1 on the right against L2 in the present study and L1-L2 on the right against L2 on the left in the studies by Palmieri et al in Brazil, Özkan et al in Turkey [Palmieri BJ et al., 2011; Ozkan U et al., 2006]. One could think the opposite because of the development of the right lobe of the liver which logically explains a lower position of the right kidney compared to the left kidney but this rule does not apply to the renal arteries, the existence of an aorto-renal angle smaller in case of lower birth explains this situation that Mohamed et al in Saudi Arabia have found [Mohamed AA et al., 2013]. Only Çiçekcibaşı et al noted an identical projection, L1 [Çiçekcibaşı AE et al., 2005].

Regarding the route, in the frontal plane, the majority of the renal arteries were concave above and upwards in 39.9% of cases. Verschuyt et al [Verschuyt E et al., 1997] and Guzzetta et al [Guzzetta P et al., 2012] also demonstrated in all cases a posterior concavity of the renal arteries with an aorto-renal angle in the horizontal plane which varies. In the literature review carried out, the actual description of the route of the renal arteries was not made.

Regarding the termination of these arteries, they mainly divide into two branches in a proportion of 88.8%, higher than that encountered by Dăescu et al in Romania and Ogeng'o et al in Kenya respectively 70% and 59.6%. [Ecaterina Dăescu et al., 2012; Ogeng'o JA et al., 2010]. The cases of division into three branches were in smaller proportion than that of Dăescu et al and Ogeng'o et al, i.e., 1.5% against 23.3% and 33.1% respectively [Ecaterina Dăescu et al., 2012; Ogeng'o JA et al., 2010]. Regarding the division into 4 branches, one case was found in this sample as in that of Dăescu et al. Ogeng'o et al did not find any [Ecaterina Dăescu et al., 2012; Ogeng'o JA et al., 2010].

CONCLUSION

The renal arteries arise on the right in an antero-lateral position on the aorta and on the left in a medio-lateral position. They are lower located on the left with a concave path backwards and upwards then head upwards. Finally 0.3% of division into four branches and 88.5% of bifurcation of terminal branches were noted. This knowledge is essential for patricians working on the kidneys.

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