OPEN ACCESS
Scholars International Journal of Anatomy and Physiology
Abbreviated Key Title: Sch Int J Anat Physiol
ISSN 2616-8618 (Print) |ISSN 2617-345X (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Numerary Anatomical Variant of Renal Arteries in Melanoderms Living in Benin

Laleye C[1,2*], Videgla BLE[1], Sogan C[1], Hadonou AA[1], Hounton SED[1], Emeka JC[1], Biaou O[3], Mehinto DK[2], Hounnou MG[1], Agossou-Voyeme AK[2]

[1]Human Anatomy Laboratory, Faculty of Health Sciences, Cotonou - Bénin
[2]Clinical University of Visceral Surgery, Teaching Hospital Center - Hubert Koutoukou Maga, Cotonou Bénin
[3]Medical Imaging Department, Teaching Hospital Center - Hubert Koutoukou Maga, Cotonou - Bénin

DOI: 10.36348/sijap.2022.v05i04.001 | **Received:** 04.03.2022 | **Accepted:** 11.04.2022 | **Published:** 27.04.2022

***Corresponding author:** LALEYE Christel Marie
Human Anatomy Laboratory, Faculty of Health Sciences, Cotonou - Bénin

Abstract

Changes in the renal arteries are common in the general population with ethnic differences. ***Objective:*** List the different anatomical varieties of the renal artery in melanoderms living in Benin. ***Methods:*** This was a retrospective study from March 1, 2016 to April 31, 2017, which is 14 months. The study population consisted of all injected abdominal CT scans clearly demonstrating the renal artery and its branches. ***Results:*** 155 abdominal CT scans were revisited, 308 renal pedicles were virtually dissected showing 339 renal arteries. The average age was 50.33 ± 17 years with extremes of 13 and 83 years. The sex ratio was 0.92. The medium caliber of the aorta at the origin of the first renal artery was 16.7 ± 3mm. It was also noted two (02) cases of single kidney located at the right and 153 pairs. The medium renal length was 97.08 ± 11.08 mm, the width 49.28 ± 8.21 mm and the average thickness 49.53 ± 9.53 mm. The prevalence of changes in the number of renal arteries was 9.4%. In more detail, the number of renal arteries are ranged from one to three. They were unique in 90.1% of cases, double in 8.7% and triple in 0.6% of cases. These variations were not related to any of the dependent variables in this study. ***Conclusions:*** Numerical variations of the renal arteries are frequent among melanoderms living in Benin. They have multiple diagnostic and therapeutic interests, hence the need for their knowledge by doctors.

Keywords: Renal arteries, anatomical variants, melanoderms, Benin, CT scan.

INTRODUCTION

Changes in renal arteries are common in the general population with social and ethnical differences [1, 2]. Indeed, they are more frequent among Africans (37%) and Caucasians (35%), than among Hindus (17%) [3-9]. The reported incidence of accessory arteries ranges from 11.3% [10] to 59.5% [11] and varies greatly according to ethnic origin [8,10-13]. Accessory arteries are clinically significant as they affect several surgical procedures, ranging from graft deployment, endovascular aneurysm repair, open aneurysmorrhaphy, to nephrectomy. The objective of this study was to identify the different anatomical varieties of the renal artery in melanoderms living in Benin.

MATERIALS AND METHODS

This study carried out in the Medical Imaging Department of the Teaching Hospital Center - Hubert Koutoukou Maga and the human anatomy laboratory of the Faculty of Health Sciences. This was a descriptive retrospective study. It took place from March 1, 2016 to April 31, 2017. The study population consisted of subjects who performed an abdominal scan during the study period, including the injected abdominal scans clearly showing the renal artery and its branches. Subjects with renal vascular disease and / or with any other acquired pathologies that may modify the anatomy of the renal artery have not been taken into account. The dependent variable was the proportion variation and the independent variables: age, sex, laterality of the artery, the diameter of the aorta at the origin of the first artery, the length of the kidney, its width, its thickness and volume.

The scanners were read with Radiant software. The 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 performed using dedicated functions of the toolbar on native sections or reconstructions as appropriate. The interpretations of the scans were recorded on an information sheet.

RESULTS

At the end of this study, 155 abdominal scans were revisited, with 308 dissected renal pedicles highlighting 339 renal arteries, taking into account cases of duplication and triplication. The average age was 50.33 ± 17 years with extremes of 13 and 83 years. The sex ratio was 0.92. The medium caliber of the aorta at the origin of the first renal artery was 16.7 ± 3mm. It was also noted two (02) cases of single kidney located on the right and 153 pairs. The average renal length was 97.08 ± 11.08 mm, the width: 49.28 ± 8.21 mm and the average thickness 49.53 ± 9.53 mm. The prevalence of changes in renal artery number was 9.4% (29 out of 308 cases).

In more detail, the number of renal arteries varied from one to three (Fig 1, 2, 3). They were unique in 90.1% of cases, double in 8.7% and triple in 0.6% of cases. This variation was not related to any of the dependent variables in this study (Tables 1 and 2). However, there was more variation among women than among men, i.e 10% (Table 1). In addition, there was 11.8% variation in renal artery on the left and 7.1% on the right (Table 3).

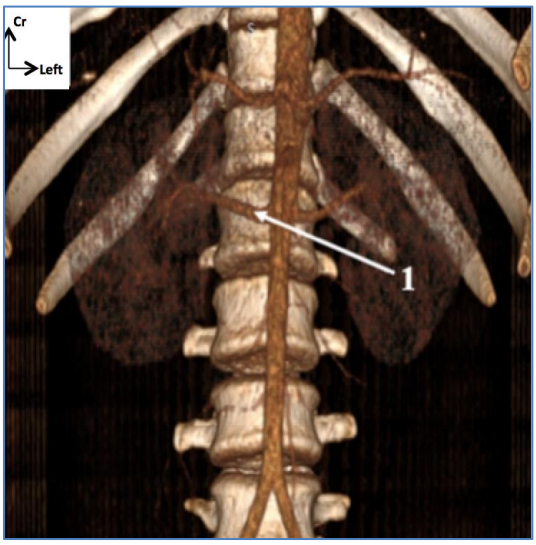

Fig-1: Volume-rendered reconstruction showing an example of a bilateral single renal artery

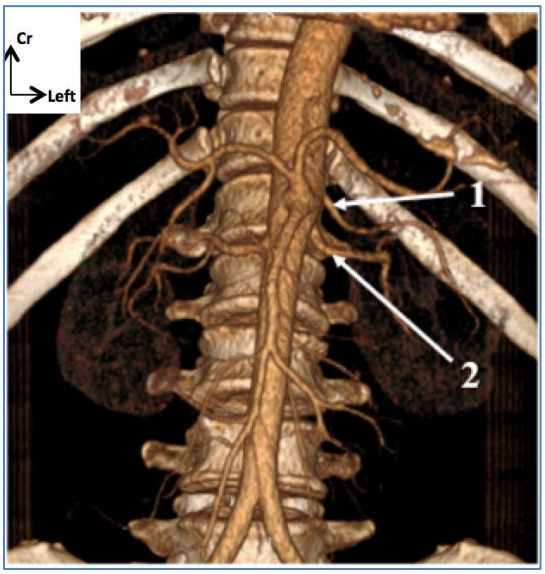

Fig-2: Volume rendering reconstruction showing an example of duplication of the renal artery on the left

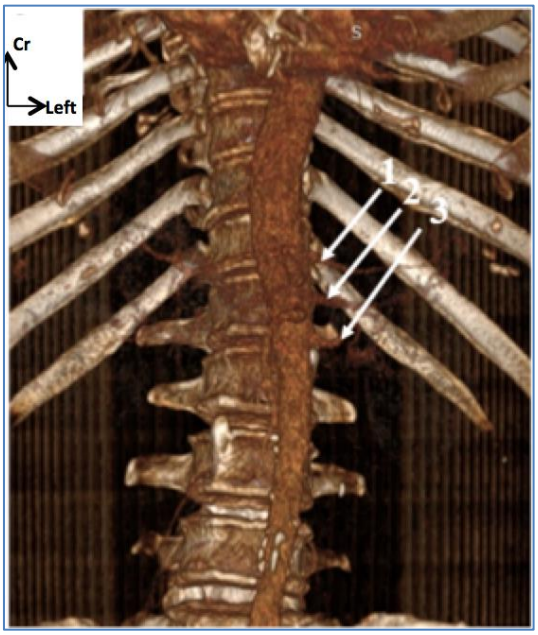

Fig-3: Volume-rendered reconstruction showing an example of triplication of the renal artery on the left.

Table-I: Distribution of the presence of numerary variation of the renal artery according to sex and laterality

	Variation (%)		Khi² Test
	Yes	No	p valeur
Sex			
Male	14 (8,9)	144 (91,1)	0,846
Female	15 (10,0)	135 (90,0)	
Laterality			
Right Left	11 (7,1) 18(11,8)	144 (92,9) 135 (88,2)	0,177

Table-II: Distribution of the presence of renal artery variations according to independent variables

	Variation				Average test	
	Average				T.Levène	T. Student
	Yes	*CI(95%)	No	CI(95%)	p-value	p-value
Age	53	46,7-59,2	50,2	48,2-52,4	0,821	0,392
Length	95,0	90,7-99,3	98,9	97,5-100,3	0,831	0,096
Width	47,5	44,7-50,3	50,4	49,4-51,4	0,329	0,085
Thickness	50,6	48-53,2	52,2	48,8-55,5	0,561	0,767
Volume	121,0	106,5-135,6	134,0	128,6-139,4	0,122	0,143
Diameter of the aorta	16,2	15,0-17,8	16,7	16,8-17,1	0,559	0,365

*:Confidence interval

Table-III: Distribution of the number of renal arteries per kidney according to the side

Laterality	Number of arteries	Size	Percentage (%)
Right	0	0	0,0
	1	144	92,9
	2	10	6,5
	3	1	0,6
Left	0	2	1,3
	1	134	86,5
	2	18	11,6
	3	1	0,6

DISCUSSION

In organogenesis, the mesonephros, metanephros, adrenal glands and gonads are supplied by a pair of mesonephric arteries originating from the dorsal aorta [14]. The 3rd, 4th and 5th pairs of lateral mesonephric arteries supply the metanephros. The caudal branches usually disappear, leaving a single persistent renal artery. When more than one of these lateral mesonephric arteries persist, multiple accessory renal arteries result [15].

The prevalence of variations in the number of renal arteries is 9.4% (29 out of 308 cases), in many studies this prevalence is much higher than this, as in that of Johnson *et al*. in the Caribbean in 2013 [10]. 36.1% (109 out of 302), Budhiraja *et al*. in India in 2013 [11]. 59.5% (44 out of 74 cases), Ozkan *et al*. in Turkey and 2006 23.6% (202 out of 885) [8]. On the other hand, other studies have found similar prevalence, i.e. 11.3% (23 cases out of 204) and 12% (6 cases out of 50) by Sungura *et al*. in 2012 in Kenya [11] and Santos-Soares *et al*. in 2013 in Brazil [15]. These variations are justified by the existence of ethnical differences found in the literature [1, 2, 16], and the variations in the materials, sungra *et al*., Ozkan *et al*., and Johnson having used arterial CT scans like the present study and Santos- Soares *et al.* and Budhiraja *et al*. on corpses.

The variation in renal artery were unique in 90.1% of cases, double in 8.7% and triple in 0.6% of cases. Table IV compares the variations in the number of renal arteries according to different studies.

Similarities are observed between the present study and those listed above with the difference first of all that there is no case of 4 renal arteries in this study unlike those of Ogengo *et al*. and Özkan *et al*. [3,8]. This variant was rare and Özkan et al's large sample of 855 patients could explain why he found cases.

Also as another difference, the proportion of duplication was higher in the sample of Palmieri *et al.* [17] than in the present study. Finally, the proportion of single renal arteries was greatest in the cohort of Budhiraja *et al*. [11] in his series of 100 dissected kidneys.

Table-IV: Comparison of variations in the number of renal arteries according to different studies.

	Renal artery			
	Unique	**Double**	**Triple**	**Quadruple**
Ogengo *et al*. [3] Kenya 2010 Cadaverous (356 Kidneys)	85,7%	11,8%	2,2%	0,3%
Budhiraja *et al*. [12] Inde 2010 Cadaverous (100 Kidneys)	91,67%	8,33%	0%	0%
Natsis *et al*. [18] Grèce 2014 Cadaverous (206 Kidneys)	83%	13%	4,3%	0%
Palmieri *et al*. [17] Bresil 2011 Angiographic (200 Kidneys)	64,2%	35,8%	0%	0%
Schönherr *et al*. [19] Belgique 2015 CT scan (248 Kidneys)	83%	16%	1%	0%
Özkan *et al*. [8] Turquie 2006 CT scan (855 patients)	85,6%	13,6%	0,7%	0,1%
Present study (339 Kidneys)	81,8%	8,2%	0,6%	0%

In this study, the variation in the number of renal arteries was not related to the age, sex, size of the kidney concerned, or to the diameter of the aorta at the origin of the first renal artery as in the study by Palmieri *et al*. [17], Famurewa *et al.* in Nigeria in 2019 found it with sex [20].

CONCLUSION

This study showed that the number of variations of the renal arteries are frequent in melanoderms living in Benin. All of the variations described have important implications in the planning of various surgical procedures. Radiologists and surgeons should strive to find and analyze all possible variants in order to avoid misdiagnosis and prevent avoidable post-surgical morbidities.

REFERENCES

1. Kadir, S., & Brothers, M. F. (1991). *Atlas of normal and variant angiographic anatomy*. WB Saunders Company.

2. Boijsen, E. (1997). Renal angiography: techniques and hazards; anatomic and physiologic considerations. *Abrams' angiography. 4th ed. Philadelphia: Little, Brown and Company*, 1101-1131.
3. Ogeng'o, J. A., Masaki, C. O., Sinkeet, S. R., Muthoka, J. M., & Murunga, A. K. (2010). Variant anatomy of renal arteries in a Kenyan population. *Annals of transplantation*, *15*(1), 40-45.
4. Saldarriaga, B., Pérez, A. F., & Ballesteros, L. E. (2008). A direct anatomical study of additional renal arteries in a Colombian mestizo population. *Folia morphologica*, *67*(2), 129-134.
5. Khamanarong, K., Prachaney, P., Utraravichien, A., Tong-Un, T., & Sripaoraya, K. (2004). Anatomy of renal arterial supply. *Clinical Anatomy: The Official Journal of the American Association of Clinical Anatomists and the British Association of Clinical Anatomists*, *17*(4), 334-336.
6. Raman, S. S., Pojchamarnwiputh, S., Muangsomboon, K., Schulam, P. G., Gritsch, H. A., & Lu, D. S. (2007). Surgically relevant normal and variant renal parenchymal and vascular anatomy in preoperative 16-MDCT evaluation of potential laparoscopic renal donors. *American Journal of Roentgenology*, *188*(1), 105-114.
7. Tarzamni, M. K., Nezami, N., Rashid, R. J., Argani, H., Hajealioghli, P., & Ghorashi, S. (2008). Anatomical differences in the right and left renal arterial patterns. *Folia morphologica*, *67*(2), 104-110.
8. Özkan, U., Oguzkurt, L., Tercan, F., Kizilkilic, O., Koç, Z., & Koca, N. (2006). Renal artery origins and variations: angiographic evaluation of 855 consecutive patients. *Diagnostic and interventional Radiology*, *12*(4), 183.
9. Chai, J. W., Lee, W., Yin, Y. H., Jae, H. J., Chung, J. W., Kim, H. H., & Park, J. H. (2008). CT angiography for living kidney donors: accuracy, cause of misinterpretation and prevalence of variation. *Korean journal of radiology*, *9*(4), 333-339.
10. Johnson, P. B., Cawich, S. O., Shah, S. D., Aiken, W., McGregor, R. G., Brown, H., & Gardner, M. T. (2013). Accessory renal arteries in a Caribbean population: a computed tomography based study. *Springerplus*, *2*(1), 1-5.
11. Budhiraja, V., Rastogi, R., & Asthana, A. K. (2010). Renal artery variations: embryological basis and surgical correlation. *Rom J Morphol Embryol*, *51*(3), 533-536.
12. Saldarriaga, B., Pinto, S. A., & Ballesteros, L. E. (2008). Morphological Expression of the Renal Artery. A Direct Anatomical Study in a Colombian Half-caste Population. *International Journal of Morphology*, *26*(1).
13. Papaloucas, C., Fiska, A., Pistevou-Gombaki, K., Kouloulias, V. E., Brountzos, E. N., Argyriou, P., & Demetriou, T. (2007). Angiographic evaluation of renal artery variation amongst Greeks. *Aristotle University Medical Journal*, *34*(2), 43-47.
14. Soares, T. R. S., Ferraz, J. S., Dartibale, C. B., & Oliveira, I. R. M. (2013). Variations in human renal arteries. *Acta Scientiarum. Biological Sciences*, *35*(2), 277-282.
15. Hlaing, K. P., Das, S., Sulaiman, I. M., Abd-Latiff, A., Abd-Ghafar, N., Suhaimi, F. H., & Othman, F. (2010). Accessory renal vessels at the upper and lower pole of the kidney: a cadaveric study with clinical implications. *Bratisl Lek Listy*, *111*(5), 308-310.
16. Khamanarong, K., Prachaney, P., Utraravichien, A., Tong-Un, T., & Sripaoraya, K. (2004). Anatomy of renal arterial supply. *Clinical Anatomy: The Official Journal of the American Association of Clinical Anatomists and the British Association of Clinical Anatomists*, *17*(4), 334-336.
17. Palmieri, B. J., Petroianu, A., Silva, L. C., Andrade, L. M., & Alberti, L. R. (2011). Study of arterial pattern of 200 renal pedicle through angiotomography. *Revista do Colégio Brasileiro de Cirurgiões*, *38*, 116-121.
18. Natsis, K., Paraskevas, G., Panagouli, E., Tsaraklis, A., Lolis, E., Piagkou, M., & Venieratos, D. (2014). A morphometric study of multiple renal arteries in Greek population and a systematic review. *Rom J Morphol Embryol*, *55*(3 Suppl), 1111-22.
19. Schönherr, E., Rehwald, R., Nasseri, P., Luger, A. K., Grams, A. E., Kerschbaum, J., ... & Glodny, B. (2016). Retrospective morphometric study of the suitability of renal arteries for renal denervation according to the Symplicity HTN2 trial criteria. *BMJ open*, *6*(1), e009351.
20. Famurewa, O. C., Asaleye, C. M., Ibitoye, B. O., Ayoola, O. O., Aderibigbe, A. S., & Badmus, T. A. (2018). Variations of renal vascular anatomy in a nigerian population: A computerized tomography study. *Nigerian journal of clinical practice*, *21*(7), 840-846.