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Case Report
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Bilateral Double Renal Arteries Variation: a Case Report

Beatriz Carmona Ferreira-Pileggi[1], Luana Soares de Godoy[2], Vitoria Daolio Cruz[2], Ana Cláudia Rossi[1], Felippe Bevilacqua Prado[1], Alexandre Rodrigues Freire[1, 2]

[1]Department of Biosciences, Anatomy Division, Piracicaba Dental School, University of Campinas (UNICAMP), Piracicaba, SP, Brazil
[2]Einstein Integrated Faculties of Limeira, Limeira, SP, Brazil

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ABSTRACT

Introduction: the vascularization of the kidney is given by the renal arteries, a pair of lateral branches from the aorta artery, and each kidney receives blood supply by a single renal artery. The study aimed to report an anatomical variation of the renal arteries.

Case report: during a routine Anatomy class, double renal arteries were found bilaterally in a Brazilian adult male cadaver. On the right side, both arteries entered the renal hilum, and the renal vein passed superficially to the inferior branch of the renal artery. On the left side, before entering the renal hilum, the arteries crossed, and the superior branch passed superficially to the inferior branch. Moreover, the renal vein passed superficially to the superior branch before the artery entered the renal hilum and passed posteriorly to the inferior branch before joining the inferior vena cava.

Conclusion: the presence of multiple arteries increases the difficulty of surgery procedures. Knowledge of anatomic variations of vessels in the renal hilar is especially important to contribute to the success of surgical invasive and radiological procedures of this area, for adequate surgical planning and to avoid vascular complications.

Keywords: Anatomic variation; renal artery; anatomy; kidney.

Introduction

The vascularization of the kidney is given by the renal arteries, a pair of lateral branches from the aorta artery. Each kidney receives blood supply from a single renal artery, left renal artery and right renal artery, which originates from the abdominal aorta artery below the origin of the superior mesenteric artery, about the level of the intervertebral disc between the first and the second lumbar vertebra (Khamanarong *et al*., 2004; Budhiraja *et al*., 2011; Verma *et al*., 2012; Pradhay *et al*., 2021; Famurewa *et al*., 2022). The renal artery enters the renal hilum anteriorly to the renal vein and posteriorly to the renal pelvis, and then divides into anterior and posterior branches, which in turn divide into some segmental arteries to supply each specific renal segment (Budhiraja *et al*., 2011; Pradhay *et al*., 2021).

Anatomic variations of the renal artery include number, source, and course (Khamanarong *et al*., 2004; Verma *et al*., 2012). The literature shows that renal artery variations are common in the general population and the frequency differs among the populations, being reported as varying from 9 to 76% (Khamanarong *et al*., 2004; Özkan *et al*., 2006).

The renal arterial anatomy and its variations are of interest of radiologists and surgeons and this knowledge has importance in renal transplantation, vascular reconstructions, renal artery embolization, conservative or radical renal surgery, such as nephrectomy and segmental resection (Khamanarong *et al*., 2004; Gupta *et al*., 2010; Ali Mohammed *et al*., 2012). Knowing the anatomic variations is essential for safe and efficient renal procedures. These professionals must be knowledgeable about the type and prevalence of the variants and the individual patient's renal vascular anatomy to avoid surgical complications and diagnostic pitfalls (Khamanarong *et al*., 2004; Ribeiro *et al*., 2007; Famurewa *et al*., 2022).

The aim of the study was to report an anatomical variation of the renal arteries found in a Brazilian cadaver during a routine Anatomy class.

Case Report

During a routine Anatomy class at the Anatomy Laboratory of the Einstein Integrated Faculties of Limeira, SP, Brazil, double renal arteries were found bilaterally (figure 1) in a Brazilian adult male cadaver. The kidneys, ureters, urinary bladder, and the prostate had already been removed from the cadaver and the aorta artery and inferior vena cava were sectioned superiorly at the level of the kidneys and inferiorly it is possible to see the common iliac, internal iliac, and external iliac arteries and the common iliac veins.

On the right side (figure 2), both renal arteries had their origins very close from the abdominal aorta artery. Both arteries entered the renal hilum, and the renal vein passed superficially to the inferior branch of the renal artery. The renal pelvis passed posteriorly to both renal arteries.

On the left side (figure 3), both renal arteries had their origins from the abdominal aorta artery, with

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a greater distance between the origin of the two branches when comparing to the right side. Before entering the renal hilum, the arteries crossed, and the superior branch passed superficially to the inferior branch (figure 4). Moreover, the renal vein passed superficially to the superior branch before the artery entered the renal hilum and passed posteriorly to the inferior branch before joining the inferior vena cava. The renal pelvis passed posteriorly to both renal arteries.

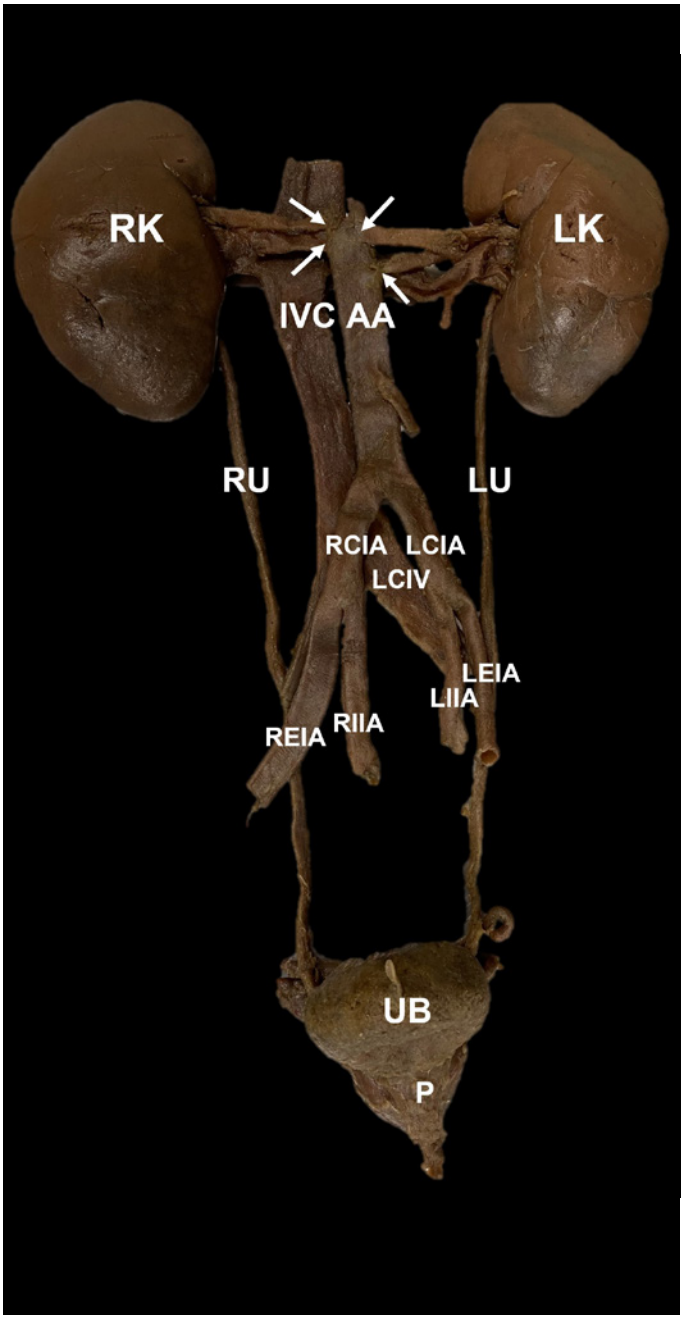

Figure 1. The kidneys, ureters, urinary bladder, and the prostate from the Brazilian cadaver. RK: right kidney. LK: left kidney. AA: aorta artery. IVC: inferior vena cava. RCIA: right common iliac artey. REIA: right external iliac artery. RIIA: right internal iliac artery. LCIA: left common iliac artery. LEIA: left external iliac artery. LIIA: left internal iliac artery. LCIV: left common iliac vein. RU: right ureter. LU: left ureter. UB: urinary bladder. P: prostate. The white arrows indicate the origins of the renal arteries from the aorta artery.

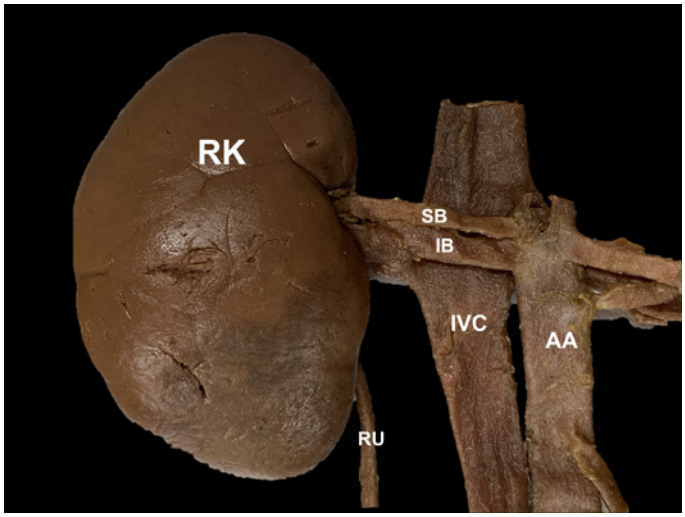

Figure 2. The right kidney with double renal arteries. RK: right kidney. SB: superior branch. IB: inferior branch. AA: aorta artery. IVC: inferior vena cava. RU: right ureter.

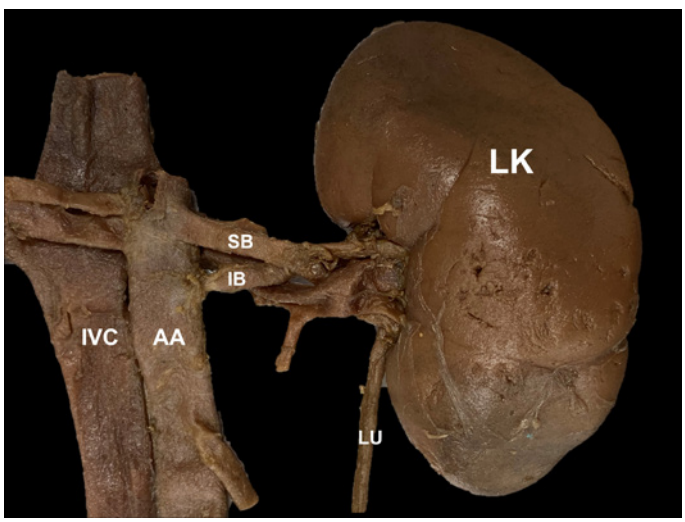

Figure 3. The left kidney with double renal arteries. LK: left kidney. SB: superior branch. IB: inferior branch. AA: aorta artery. IVC: inferior vena cava. LU: left ureter.

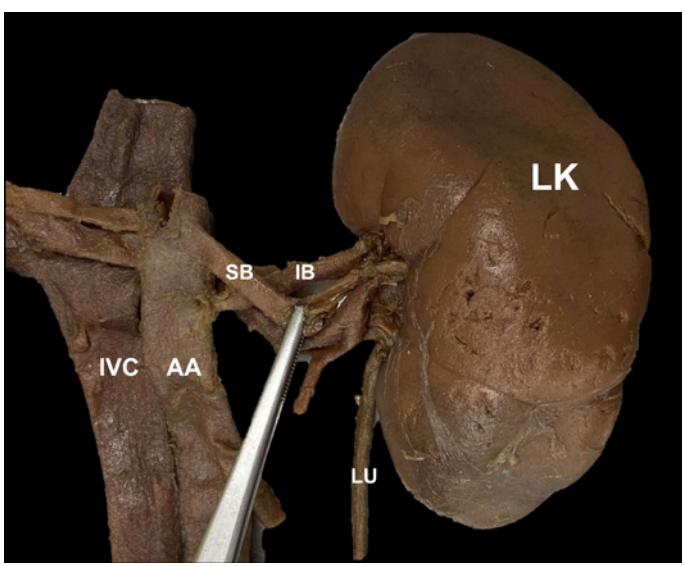

Figure 4. The left kidney with double renal arteries. The superior branch was displaced to show the crossed branches. LK: left kidney. SB: superior branch. IB: inferior branch. AA: aorta artery. IVC: inferior vena cava. LU: left ureter.

Discussion

Supplementary renal arteries (double or triple) entered the kidney through the hilum. According Bordei *et al.* (2004), the renal artery with a larger caliber was designated the main renal artery and the other was designated the supplementary renal artery. Double renal arteries with origin from the abdominal aorta represent a frequent variation (Bordei *et al*., 2004).

According to Oesterwitz *et al.* (1985), multiple renal arteries exist in 18% to 30% of the general population. Nonetheless, the incidence of double renal arteries varies among populations, and studies report different values of the incidence of this variation, such as 2% (Hassan *et al*., 2017), 17.2% (Sarier *et al*., 2020), 17.43% (Khamanarong *et al*., 2004), 20% (Bordei *et al*., 2004), 23% (Pollak *et al*., 1986), 25.72% (Mansur *et al*.,2019).

The present case report shows an anatomical variation of double renal arteries present bilaterally in a Brazilian cadaver, with both arteries originating from the abdominal aorta artery and entering the renal hilum. In the literature, there is a diversity regarding the side and the presence of multiple arteries. A study from Bordei *et al.* (2004) evaluated 272 kidneys from individuals from Romania and the authors found a frequency of 20% of double renal arteries supplying one kidney and originating from the aorta. Of these cases, 42 were unilateral, with 25 being on the left side, and 6 were bilateral (12 kidneys). Pradhay *et al.* (2021) performed a study in which they evaluated 100 kidneys from 50 subjects from India and the authors reported that 18% of kidneys observed had multiple renal arteries, of which 88.8% had double renal arteries.

Özkan *et al.* (2006) discussed that although multiple renal arteries are common (the authors reported a prevalence of 24%), bilateral extra renal arteries are rare (prevalence of 5%). Palmieri *et al.* (2011) analyzed the renal arteries from 200 Brazilian individuals and reported that multiple renal arteries were observed in 61.5% of the patients, of which 41% of them presented bilateral multiple renal arteries. The authors also stated that there is a higher prevalence of multiple renal arteries than that described in the literature (Palmieri *et al*., 2011).

Apparently, the supplementary renal artery variations occur due to racial and geographical differences. The presence of multiple arteries increases the difficulty of surgery procedures, which justifies the clinical importance of detailed knowledge of arteries anatomical variations of different regions of the body (Palmieri *et al*., 2011; Famurewa *et al*., 2022). It is essential for correct interpretation of imaging exams and to provide anatomical information before performing surgical procedures, which will guide decisions on surgical techniques of each individual patient (Ranade *et al*., 2007; Çıra *et al*., 2015; Famurewa *et al*., 2022). Knowledge of anatomic variations of vessels in the renal hilar is especially important to contribute to the success of surgical and radiological procedures of this medical specialty, for adequate surgical planning and to avoid any vascular complication (Kayalvizhi *et al*., 2011; Verma *et al*., 2012; Mansur *et al*., 2019; Pradhay *et al*., 2021).

Kidney transplantation is commonly performed in end-stage renal disease patients. Many of the current challenges with donor grafts may exist due to the presence of anatomic variations, and when considering all of them, multiple renal arteries are the most common (Ersöz *et al*., 2000). Transplanting a kidney with multiple renal arteries has several disadvantages, as multiple renal arteries have been reported as being associated with a higher rate of vascular complications (Oesterwitz *et al*., 1985; Roza *et al*., 1989; Guerra *et al*., 1992; Benedetti *et al*., 1995; Çıra *et al*., 2015). Anatomic evaluation of the renal vessels has an important place in a kidney transplant decision (Çıra *et al*., 2015).

Some cases in which accessory renal arteries are present may require arterial reconstruction and anastomosis involving arteries with relatively small diameters (Famurewa *et al*., 2022).

In conclusion, the anatomical variation reported is important to guide medical area professionals in different clinical procedures.

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Mini Curriculum and Author's Contribution

1. Beatriz Carmona Ferreira-Pileggi - DDS; PhD student. Contribution: Effective scientific and intellectual participation for the study; wrote the manuscript; critical review and final approval. ORCID: 0000-0001-6845-7881.

2. Luana Soares de Godoy - Undergraduate student. Contribution: Wrote the manuscript; critical review and final approval. ORCID: 0000-0002-9676-5336.

3. Vitoria Daolio Cruz – Undergraduate student. Contribution: Wrote the manuscript; critical review and final approval. ORCID: 0000-0002-4762-7180.

4. Ana Cláudia Rossi - DDS, PhD, Associate Professor. Contribution: Wrote the manuscript; critical review and final approval. ORCID: 0000-0002-8718-4898.

5. Felippe Bevilacqua Prado - DDS, MSc, PhD, Associate Professor. Contribution: Wrote the manuscript; critical review and final approval. ORCID: 0000-0001-5636-6915.

6. Alexandre Rodrigues Freire - DDS, MSc, PhD, Researcher. Contribution: Effective scientific and intellectual participation for the study; Wrote the manuscript; critical review and final approval. ORCID: 0000-0002-0175-0896.

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Corresponding author
Alexandre R. Freire
E-mail: alerfreire@gmail.com