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BILATERAL VARIATIONS IN THE BLOOD SUPPLY OF KIDNEYS

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ABSTRACT

Classically renal arteries are a pair of lateral branches from the abdominal aorta. Each kidney is supplied by single renal artery and a single renal vein However, current literature report great variability in renal blood supply, the number of renal arteries and the arrangement of hilar structures on the left side. In the present paper is described a case of origin of three renal artery found in the both sides; on the right side the main renal artery and the upper branch took their origin from a common trunk coming out of the lateral aspect of the abdominal aorta, the lower branch took origin from the anterior aspect of the abdominal aorta.

On the left side the three renal arteries had separate origins of the abdominal aorta, three renal arteries gives rise to 7 branches. Both found three kidney renal vein, but In the left kidney was found three renal veins, which formed a common trunk that ran obliquely passing behind the abdominal aorta (retro – aortic) and draining into the inferior vena cava, further at the hilum was found embracing the main renal artery and the upper arterial branch. Proper knowledge of variations of the arteries supplying the kidney is essential not only to the anatomists but also to surgeons.

KEYWORDS: Anatomical Variations, Kidneys, Renal Artery, Renal Vein, Renal Hilum

INTRODUCTION

Renal arteries arise from the abdominal aorta below the origin of the superior mesenteric artery, on each side. Near the hilum of the kidney, each renal artery divides into anterior and posterior branches, which in turn divide into a number of segmental arteries supplying the different renal segments. The presence of unusual branching patterns of the renal arteries is not uncommon. In 70% of cases there is a single renal artery supplying each kidney[(1)].

Renal arteries exhibit a high degree of variations. Most of these variations remain undiscovered until being noticed during a surgical procedure or they are found by forensic pathologists during autopsy[(2,3)]. The venous drainage of each kidney is through a single renal vein, which drains the blood from the kidney into the inferior vena cava. The left renal veinal so receives left suprarenal and left gonadal veins, in addition to the vein coming out from the kidney[(4)].

The renal hilum is a vertical slit on the medial border of the kidney, which is bound by the thick lips of the renal substance[(5)]. Classically, the topographic arrangement of the hilar structures is referred to in the an tero-posterior sense, as its vein-artery-pelvis[(6)]. Various kidney disorders pose fatal complications such as a risk of cardio morbidity, hospitalization or even death[(7)]. Nephrectomy is being used as a choice of a therapeutic procedure towards certain kidney disorders in which the functional units of the nephrons are spared[(8)].

A Laparoscopic Partial Nephrectomy (LPN) minimizes the risk of a radical nephrectomy. However, the LPN procedure is a very complicated and a technically challenging task for the urologists, as it requires the skill of ligation or clamping of the vessels which are present in the narrow spaced hilum[9]. However, clamping of the individual structures is beneficial than the en-bloc clamping procedures[10].

Hence, it is necessary to have an ample knowledge on the arrangements of the renal hilar structures before making a surgical approach, as these arrangements and the number of structures in the hilum are highly variable than the actual patterns which are given in the standard text books. On reaching the hilum, the renal arteries usually divide into the anterior and the posterior divisions.

The posterior division of the renal artery and the posterior tributary of the renal vein may generally enter the kidney tissue, posterior to the pelvis, in some cases[6, 11]. The surgeons who perform endopyelotomies should be aware of the arrangements of the structures at the hilum of the kidney. Many of the investigative imaging and angiographic procedures have described the abnormal anatomies of the hilar structures, which were detected mainly as incidental findings. Many studies have been done on the anatomical analysis of the arrangements of the structures in the renal hilum[12].

MATERIALS AND METHODS

The described arterial and venous anatomic variations were found in the right and left side of a male cadaver of 65 years of age during routine abdominal dissection in the Morphology Laboratory at the University of Pamplona developed by training medical students. The history of the individual and the cause of death are not known. The topographic details of the arteries and veins were examined by casual dissection and the variations were recorded and photographed.

RESULTS

On the Left Side

The size of the left kidney was 13x6x5cms. It received three renal arteries with separate origins of the abdominal aorta. The left main renal artery took their origen from the anterior aspect of the abdominal aorta at the level of L1 vertebra; the upper branch took origin from the lateral aspect of the abdominal aorta at level of L1 vertebra just superior to left main renal artery; the lower branch took their origin from the anterior aspect of the abdominal aorta at the level of L2 vertebra.

Among all the renal arteries, the upper branch was the thickest and even the two branches (uppery lower) were of greater caliber than the left main renal artery. Prehiliar level three renal arteries are divided and gaverise to seven branches: the left main renal artery originates two branches; the upper branch originates four branches and the lower branch originates one branch. The venous drainage of the left kidney is through three renal veins that bind and form a common venous trunk which corresponds to the left renal vein, which receives venous tributaries, above the inferior phrenic vein and under the testicular vein, the left renal vein ran obliquely passing passing behind abdominal aorta (retro-aortic) and draining into the inferior vena cava at level of L4, further, at the hilum was found that the renal veins embraced the main renal artery and the upper arterial branch. (Figure 1).

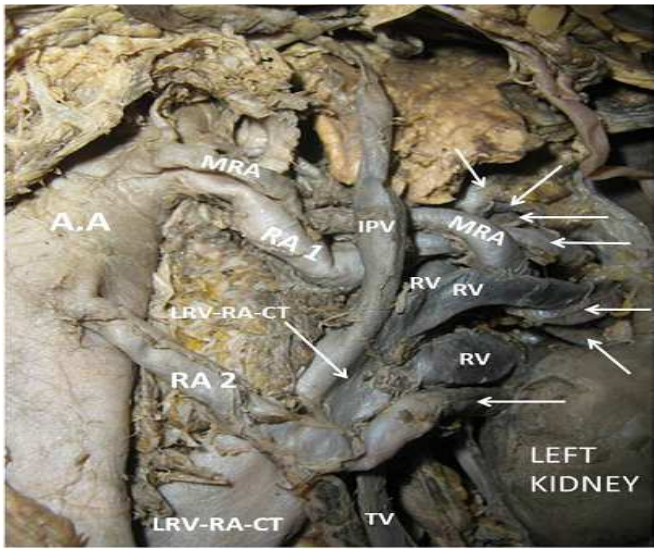

Figure 1: Anterior View of Retroperitoneal Upper Left Region Showing Details of Hiliar Renal Region. A.A: Abdominal Aorta; MRA: Main Renal Artery; RA 1: Upper Branch from the Abdominal Aorta; RA 2: Lower Branch from the Abdominal Aorta; RV: Renal Vein; TV: Testicular Vein; LRV-RA-CT: Left Renalvel in-Retro-Aortic-Common Trunk; IPV: Inferior Phrenicvein. Arrows Showing 7 Branches of Renal Artery

On the Right Side

The size of the right kidney was 13x6x4cms. It received three renal arteries. The right main renal artery and upper branch took their origen from a common trunk coming out of the lateral aspect of the abdominal aorta at the level of L1 vertebra. The other artery (lower branch) took their origin from the anterior aspect of the abdominal aorta at the level of L2 vertebra. The venous drainage of the rigtht kidney is through three renal vein, which formed a common venous trunk draining the blood from the kidney into the inferior vena cava. The arrangement of the structures in the hilium antero-posteriorly was right renal artery from lower branch of the abdominal aorta), three veins renal, right main renal artery, renal artery from upper branch both from the common trunk of the abdominal aorta and renal pelvis. (Figure 2).

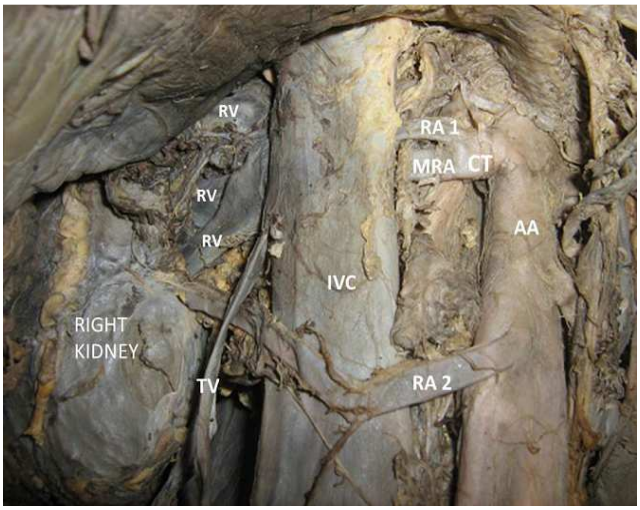

Figure 2: Anterior View of Retroperito Neal Upper Right Region Showing Details of Hiliar Renal Region. AA: Abdominal Aorta; MRA: Main Renal Artery and RA 1: Upper Branch from the Common Trunk Respectively; RA 2: Lower Branches from Abdominal Aorta; IVC: Inferior Vein Cava; RV: Renal Veins; TV: Testicular Vein

DISCUSSIONS

The renal arteries arise from the aorta just below the level of origin of the superior mesenteri cartery. Renal artery variations including their numer, source and course are very common. The accessory renal arteries are seen frequently. Irregularities of renal vessels are found in about 30%- 35% of cases. They enter the kidney either above or below the hilum. The irrelations with the near by structures can vary[12-16]. Bayramoglu et al, reported bilateral additional renal arteries originating from the abdominal aorta and an additional right renal veinac companying the additional right renal artery. The seanomalies were associated with unrotated kidney swith extrarenal calyces and pelvis[17].

The abnormalities in the renal arteries are mainly due to the various developmental positions of the kidney[18]. The kidneys begin their development in the pelviccavity and then as send to their final position in the lumbar region. When the kidneys are situated in the pelvis, they are supplied by the branches of common iliacarteries. While the kidneys ascend to lumbar region, their arterial supply also shifts from common iliacartery to the abdominal aorta.

Accessory renal arterie sarise from the abdominal aorta either abover below the main renal artery and follow it to the hilum. It is important to be aware that accessory renal arteries are end arteries; therefore, if an accessory artery is damaged, the part of kidney supplied by it is likely to becomes egmentalis chaemia with subsequent hypertension. The renal veins are the tributaries of the inferior vena cava. The right renal vein receives blood only from the right kidney, where a sthe left renal vein receives blood from the left suprarrenal gland and left gonad, through the suprarenal and gonadal veins[4]and 15% received by the left in ferior phrenicvein[19]. Variations of renal veins are rare compared to the renal arteries. Variations of right renal veins are more common tan left renal veins[12].

Janschek et al, reported cases of multiple renal veins. In their study, variations were more common on the right side (23%) tan on the left (6.7%)[20]. Senecail et al, reported two un common anatomical variations of the left renal vein. They found a circumaorticvenous ring and a retro-aorticbifid left renal vein. The first anomaly resulted from the persistence of thee mbryonic renal venous collar. The second one was due to a particular pattern of left inferior vena cava[21]. Doubling of the right renal veins has been reported by Malcic- Gürbüz et al, also reported the branching of the left renal vein. According to their report, the left renal vein divided into three branches and the upper branch among the three drained into the azygosvein, while the lower two branches drained into the inferior vena cava[22]. In a next ensive study on left renal vein variations by Satyapalet al, renal collars were found in 0.3%, retro-aorticvein in 0.5%, additional veins in 0.4%, and posterior primary tributary in 23.2% of cases[14].

The variations which are reported here, have already been reported as individual cases of variations, but occurrence of bilateral variations of the renal artery and renal vein, in the same personis a rare variation. In the present case the presence of three renal arteries and three renal vein smay compress the renal pelvis and result in hydronephrosis.

The arterial variations, like any othe ranatomical variations, cannot be ignored during the surgical procedures of the abdomen. The awareness of these variations in the origin of the arteries in this region of hilum of the kidney, and para-a orticregion, may be of utmost importance to urologists who perform nephron-preserving surgery, kidney transplantation, and the management of renal vascular hypertension. The sevariations can be demonstrated pre operatively by selective angiography. Possessing the knowledge on the distribution of the renal hilar structures is of crucial importance forur logical surgical procedures which in volve the hilar vessel clamping.[12].

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