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CT DEMONSTRATION OF VASCULAR ANATOMY IN PELVIC ECTOPIC KIDNEY*

Ilgaz AKDOGAN[1], Nevzat KARABULUT[2], Bulent OZDEMIR[1], Esat ADIGUZEL[1], Baki YAGCI[2]

A rare case of an ectopic kidney was detected during an abdominal CT examination of a 54-year-old female. While the right kidney was in the normal position, the left one was located in the pelvic fossa between the L3 and S1 vertebral levels. It received its blood supply from two renal arteries. The first renal artery to the ectopic kidney (A1) was from the distal aorta at the level of L3 entering the superior pole of the kidney on the lateral side, and the second renal artery to the ectopic kidney (A2) was from the contralateral common iliac artery posteriorly at the L3–L4 intervertebral disc level. The renal vein was anterior to the renal artery and drained into the left common iliac vein. The left renal pelvis was anterior to the renal vein. A knowledge of the renal vascular anatomy in ectopic kidneys is important in kidney transplantation and aortic surgery.

Key Words: Kidney, ectopic, pelvic kidney, vessel, CT.

PELVİK EKTOPİK BÖBREĞİN VASKÜLER ANATOMİSİNİN BT İLE GÖSTERİLMESİ

54 Yaşında kadın hastanın abdominal BT incelemesi sırasında, nadir olarak rastlanan bir ektopik böbrek tespit edildi. Sağ böbrek normal pozisyondayken, sol böbrek pelvis içinde, L3-S1 vertebralar seviyesinde yerleşmişti. Sol böbrek, iki renal arterden besleniyordu; bir arter (A1) L3 seviyesinde aorta'nın distalinden çıkıyor ve böbreğin üst ucundan böbreğe giriyordu. Ektopik böbreğin ikinci arteri (A2) ise kontrlateral a.iliaca communis'in arka tarafından, L3-L4 intervertebral aralık seviyesinden çıkıyordu. Renal ven, renal arterin önünde yer alıyor ve sol v.iliaca communis'e dökülüyordu. Sol renal pelvis, renal venin önünde yerleşmişti. Ektopik böbreklerin damarlanmasının bilinmesi böbrek transplantasyonu ve aortik cerrahide önemlidir.

Anahtar Kelimeler: Böbrek, ektopik, pelvik böbrek, damar, BT.

INTRODUCTION

An ectopic kidney that resides in the bony pelvis and below the aortic bifurcation is called a pelvic kidney (1). Pelvic kidneys have an anomalous vascular supply and collecting systems (1-3). Therefore, careful radiological and functional evaluation of these kidneys must be performed, particularly before renal transplantation and aortic surgery (1). The development of cross-sectional imaging techniques has enabled the delineation of vascular anatomy in a non-invasive manner. In this paper, we present the CT demonstration of vascular anatomy in a case of pelvic ectopic kidney.

CASE REPORT

A 54-year-old female was referred for a CT scan for the evaluation of abdominal pain. A contrast-enhanced helical CT examination of the abdomen was performed using a dual slice scanner (Mx8000, Philips Medical Systems, Cleveland, Ohio, USA) during a single breath-hold. The right kidney was in the normal position, but the left kidney was located in the pelvic fossa between the L3 and S1 vertebral levels. In order to delineate the feeding and draining vessels of the ectopic kidney, CT angiography was obtained using 2 x 2.5-mm collimation, 120 kV, and 300 mAs, and a pitch of 1.75. The CT examination was initiated 45 s after the administration of 120 ml of iodine-based non-ionic contrast material (300 mg I /ml) at a rate of 3 ml/s. From the raw data of each acquisition, 3.2-mm-thick transverse sections were reconstructed with 1.6-mm increments. All CT images were transferred to a workstation monitor (MxViewexp; release 4.01, Philips Medical Systems), and 3-dimensional reconstructions with volume rendering were performed (Fig. 1a). The reconstructed image was then transferred to a personal computer and the image was processed and drawing was carried out on it using software (Adobe Photoshop 6.0) (Fig. 1b). The patient gave verbal and written consent for CT angiography.

An ectopic left kidney measuring 10 x 8 x 8 cm was detected in the pelvic fossa between the L3 and S1 vertebral levels. The left renal hilum was situated anteriorly and the renal pelvis was anterior to the renal vein (Fig. 1a, 1b, 2c). CT showed that the ectopic kidney received its blood supply from two renal arteries. The first renal artery to the ectopic kidney (A1) was from the distal aorta, laterally at the level of the L3 vertebra. It was 4 mm in diameter at its origin. This artery entered a notch within the renal parenchyma on the lateral side of the upper pole (Fig. 1a, 1b, 2b). The second renal artery to the ectopic kidney (A2) arose from the contralateral right common iliac artery posteriorly at the L3 – L4 intervertebral disc level and entered the renal hilum (Fig. 1a, 1b, 2b). The diameter of this artery was 4 mm at its origin. The renal vein was anterior to the renal artery, and drained into the left common iliac vein (Fig. 1a, 1b). The ureter of the pelvic kidney lay on the common iliac vessels and inserted into the ipsilateral side of the bladder. The

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[1] Department of Anatomy, Pamukkale University School of Medicine, Denizli, Turkey

[2] Department of Radiology, Pamukkale University School of Medicine, Denizli, Turkey

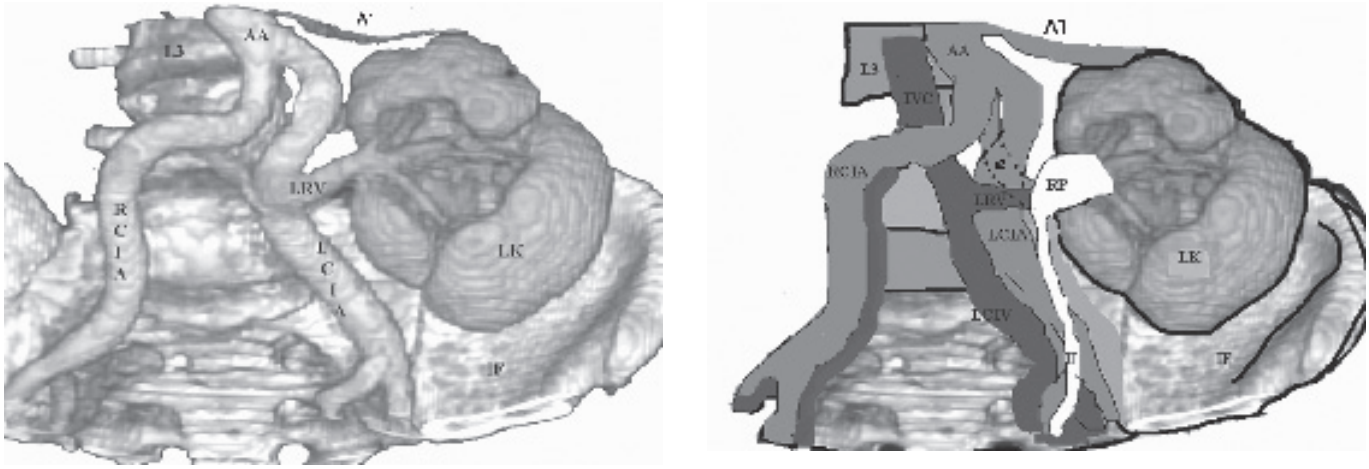

Figure 1: 3-dimensional CT reconstruction using volume rendering (a) and the schematic representation (b) shows the vascular anatomy of the left pelvic kidney (anterior view).
AA-abdominal aorta, IVC-inferior vena cava, L3-3rd lumbar vertebrae, A1- the first renal artery to the ectopic kidney, LCIA-left common iliac artery, RCIA-right common iliac artery, LCIV-left common iliac vein, A2- the second renal artery to the ectopic kidney, LRV-left renal vein, LK-left kidney, IF-iliac fossa, RP-renal pelvis, U-ureter.

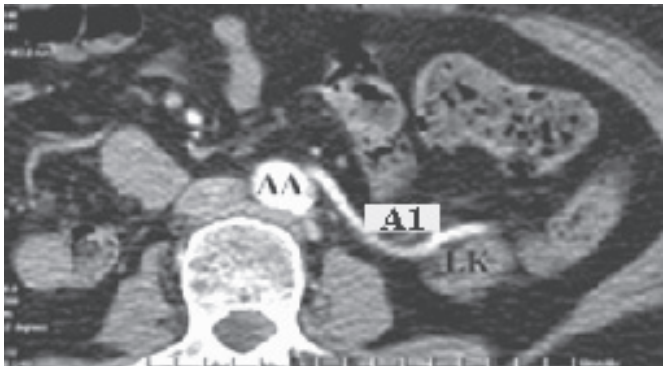

Figure 2: Axial CT scans showed that the first renal artery to the ectopic kidney was from the distal aorta (a), the second renal artery to the ectopic kidney was from the right proximal iliac artery (b), and the location of hilar structures (c). Note the first renal artery courses on the lateral side of the ectopic kidney (b).
Figure 2a: AA-abdominal aorta, A1- the first renal artery to the ectopic kidney, LK-left kidney.

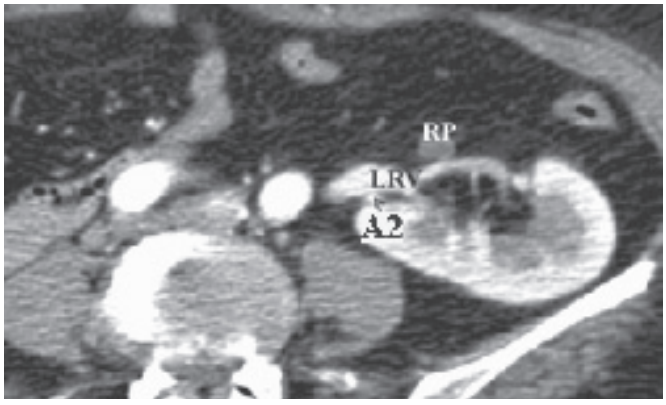

Figure 2b: LRV-left renal vein, RP-renal pelvis, A2- the second renal artery to the ectopic kidney.

right kidney was located in the normal position and no other abdominal abnormalities were identified.

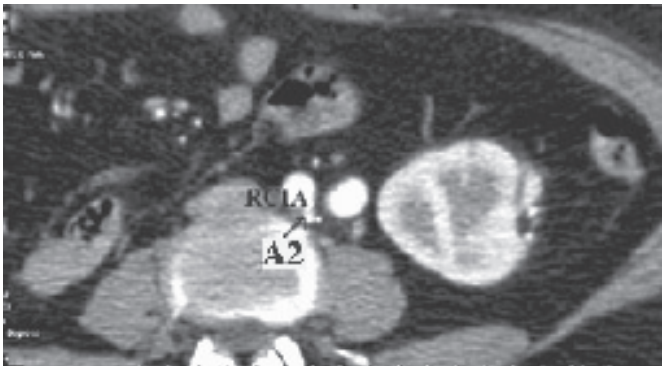

Figure 2c: RCIA-right common iliac artery, A2- the second renal artery to the ectopic kidney.

DISCUSSION

A precise knowledge of the renal vascular anatomy is essential before renal transplantation, vascular reconstructions, and various abdominopelvic surgical and radiological procedures (4). Contrast-enhanced helical CT acquires volumetric images in a single breath-hold and allows the surgeon to perform radiological laparotomy and visualize abdominal vessels non-invasively. Pelvic kidney has been reported to occur in 1/2100-3000 autopsies (1). Pelvic kidneys have an anomalous vascular supply and collecting systems. There may be a single renal artery or multiple. Anomalous renal arteries may arise from the distal aorta, superior mesenteric, common iliac, internal iliac or external iliac arteries (5). The venous anatomy may vary as well. Extrahilar renal arteries from the renal artery or aorta may enter the external surface of the kidney, commonly at its poles. The literature indicates that multiple renal arteries range between 9% and 76% (2,4,6). Khamanarong et al. studied the anatomy of the orthotopic renal arterial supply and found one hilar artery combined with one upper polar artery in 7% (4% on the right, 3% on the left) of 534 cadaveric kidneys (4). The presence of anomalous vascular vessels causes problems during kidney operations.

Gulsun et al. reported a right pelvic kidney that was supplied by three arteries: the contralateral common iliac artery, ipsilateral internal iliac artery and ipsilateral common iliac artery. The third artery entered the kidney laterally, whilst the first two entered medially (2). The artery arising from the contralateral common iliac artery was similar to that seen in our case. In addition, Ohtsuka et al. reported three arteries to the ectopic kidney from the aorta at the L3 level and reported two veins draining to the IVC and ipsilateral common iliac vein from the ectopic kidney at the L3 level (7).

Pelvic ectopic kidneys occur when the kidney fails to ascend from the pelvis, which normally develops by the ninth week. As the kidney ascends from the pelvis, it receives its blood supply from the vessels that are closely related to them. Initially, the renal arteries are the branches of the common iliac arteries. As they ascend further they receive their blood supply from the distal end of the aorta. When they reach a higher level, they receive new branches from the aorta and the inferior branches normally undergo involution, and disappear (8). In our case, the left kidney failed to ascend and its blood supply originated from the distal aorta and contralateral common iliac artery.

A thorough knowledge of the variations in renal arterial supply is of paramount importance for renal transplantation, renovascular hypertension, renal artery embolization, angioplasty or vascular reconstruction for congenital and acquired lesions, reconstructive surgery for abdominal aortic aneurysms, and conservative or radical renal surgery (4,5). An association between abdominal aortic aneurysm and congenital pelvic kidney is rare. It is necessary to maintain the blood supply to the pelvic kidney during surgery for aortic aneurysm. A variety of techniques have been described to limit the ischemic damage to such abnormally pelvic kidneys (9). As in our case, the ectopic kidney can be discovered in patients undergoing contrast-enhanced abdominopelvic helical CT examinations for unrelated reasons. Therefore, the radiologist and surgeon should search for variant vascular anatomy and include it in their reports.

Correspondence Address
Dr. Ilgaz AKDOGAN
Pamukkale University, Tip Fakultesi
Anatomi Anabilim Dali, 20020, Denizli, Turkey
Phone: 0258 2134030
Fax: 0258 2132874
e-mail: iakdogan@pamukkale.edu.tr

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