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Editorial

Anatomic evaluation of living kidney donor: CT or MRI?

Evaluación anatómica del donante vivo de riñón: ¿tomografía axial computarizada o resonancia nuclear magnética?

The shortage of organs for renal transplantation is a chronic situation exacerbated in the past few years as a result of a decrease in cadaveric organ donors. The situation has become even more difficult due to an increase in the number of patients with kidney failure. Spain, despite having one of the most efficient transplant systems in Europe, also has been unable to reduce the overall number of patients awaiting a kidney[1].

Suboptimal or marginal kidney transplants, kidneys from donors on asystolia, and transplants in patients with positive crossmatch and ABO group incompatibility are measures taken to increase the number of cadaveric organs. Even so, cadaveric donation is insufficient as a single source of organs[2], especially for young patients with a better clinical condition and a longer life expectancy. For these reasons, live donor programs have been reactivated in the past few years. The simultaneous development of laparoscopic surgery has incentivized living donation. Since the first laparoscopic nephrectomy at the Johns Hopkins Bayview Medical Center in 1995, this approach has spread worldwide[3]. Less postoperative pain, a short hospital stay, and a quick recuperation are the reasons why more individuals are willing to donate a kidney.

The objectives of the assessment of candidates for live kidney donation are to rule out conditions that may worsen severely after the donation, to rule out potentially transmissible diseases to the recipient, and to ensure the donor's kidney function after nephrectomy. From the urological perspective, the goal is to obtain information about the anatomy and function of the urinary tract (donors with kidney disease or severe extrarenal conditions should be excluded), to select the kidney for removal and the surgical approach and technique, and to obtain a representation of the vascular structures, the parenchyma, and the tract to help plan both the removal and the implantation, and prevent complications.

Intravenous urography and subtraction angiography are complementary imaging techniques traditionally used for urological assessment. European guidelines currently recommend using these methods if computed tomography (CT) or magnetic resonance imaging (MRI) are not available[4]. Obviously, if only one of these two techniques is available, there is no other option. Each method by itself provides sufficient information to make an adequate assessment. The question arises when both techniques are available at the hospital or when one technique is in the public system and the other in the private or combined system. A number of details differentiate these techniques and may help to decide which one to use.

In the past, it was important to know the number and location of the renal arteries and veins before performing an open nephrectomy; today, due to the more limited field of view of laparoscopic nephrectomy, more comprehensive and refined anatomic information is required. Essential details about the arteries include the detection of superior and inferior polar arteries, the presence of accessory arteries (diameter <3-4 mm) originating in the aorta, the celiac trunk, the superior mesenteric artery, the bifurcation of the aorta or the common iliac arteries, and the presence of early bifurcation (<2 cm), which determines anastomosis[5]. On the other hand, even though venous anatomy is more uniform than arterial anatomy, 92% of donors present with a single bilateral vein, whose variability has further implications on the kidney removal even further. The presence of multiple or retroaortic or circumaortic renal veins, the great variation of the retroperitoneal veins (lumbar, ascending lumbar and hemiazygos veins) as pertaining to their communication with the left renal vein, and the presence of retroperitoneal varices make extraction more difficult, and only in very expert hands does the procedure not require conversion[5,6].

Currently, with the evolution of CT and MRI, the technical differences are minor. Both methods permit explorations with very fine cuts (<1 mm) that identify small vessels in extremely short times (15-20 s) and differentiate arterial and venous phases with a wide field of view, where the longitudinal trajectory of the vessels can be visualized. Additionally, digital image processing provides maximum intensity projections that enhance small vessels, multiplanar cuts in anterioposterior and oblique views, color and gray-scale 3D reconstructions, and volumetric images that depict the entire vascular tree and its relations with neighboring structures. These images are very helpful to plan the nephrectomy, as they pertain to the anatomy encountered by the urologist[7,8].

Vascular diagnostic performance, spatial resolution and the differentiation of vascular structures is excellent for both techniques, but better for CT after 4 multidetectors. Both methods have a sensitivity and a specificity of 95% for the identification of the main artery and vein and for the detection of early arterial branching. MRI is less sensitive than multidetector CT to identify smaller arteries and veins (<3 mm). The most common pitfall is the inability to identify an accessory artery or small veins (false negative)[9,10].

Both techniques have excellent performance (close to 100%) in evaluating the renal parenchyma and the excretory tract. Sometimes MRI cannot detect lithiasis in the calyces or cyst wall calcification; CT is better for detecting lithiasis and renal, ureter, and bladder anomalies. Another issue is that MRI does not permit easy posture changes. Because CT allows for prone and recumbent positions, the bladder is more easily explored[9,10].

An important issue is the not insignificant radiation exposure of the live donor during CT scanning. Two exposures are usually done: without contrast and with contrast. Another problem is the time necessary to explore the excretory trajectory, which slows down the radiology service, which is already overloaded. Our service has established a protocol to avoid overexposure and provide maximum efficiency. First we do an ultrasound to find gross pathology that may rule out a patient from the outset. Then, a single 16-slice multidetector CT scan is done after IV injection of the contrast material; arterial phase images are obtained at 25", and a kidney and venous image is obtained at 70". Lastly, a plain X-ray of the urinary system is taken 3-5 min after the patient comes out of the CT scanner, for an exploration of the excretory path.

We therefore conclude that the anatomic assessment of the live donor depends on the availability of imaging techniques at the hospital. The absence of MRI or CT does not preclude initiating or reactivating a live transplant program, since traditional evaluation with urography and angiography remains valid. MRI and CT have a high diagnostic performance for the depiction of vessels, parenchyma, and pathways. Multidetector (<4) CT is slightly superior to MRI in small vessels, especially veins. Finally, identification failure does not have repercussions and does not affect the final outcome of the nephrectomy or the subsequent implantation.

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