New paradigms in the imaging evaluation of renal parenchymal tumors

Novos paradigmas na avaliação por imagem dos tumores parenquimatosos renais

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For a long time, imaging methods have played a secondary role in the diagnosis and therapeutic planning in cases of renal parenchymal tumors, considering that excretory urography could only detect large lesions causing bulging of the renal contour or distortion of the calyceal system, generally in symptomatic patients with advanced disease.

In this scenario, the arrival of ultrasonography (US) has represented a landmark, considering that small lesion started being incidentally diagnosed (incidentalomas), resulting in a significant improvement in survival rates, since patients diagnosed with incidental tumors with < 4 cm (T1 stage) present 95% probability of ten-year survival[1]. In the last years, the higher availability of Doppler and ultrasonographic contrast agents has contributed to increase the US applicability in the detection, therapeutic planning and post-treatment follow-up of focal renal lesions.

On its turn, computed tomography (CT) with intravenous iodinated contrast enhancement has become the method of choice in the evaluation of the greatest majority of focal renal lesions, because, besides allowing a better characterization of lesions detected by US, this method also allows an accurate pretherapeutic staging of these lesions. The current technologies, with multidetector helical CT (MDCT or multislice CT) utilizing dedicated protocols with four-phase studies (precontrast, corticomedullary, nephrographic and excretory phases) have increasingly widened the CT applicability, with shorter acquisition times, higher spatial resolution and possibility of 3D and multiplanar images reconstruction[2].

Finally, magnetic resonance imaging (MRI), with exceptional contrast resolution and digital subtraction capability, has brought a positive contribution to the evaluation of focal renal lesions particularly in patients presenting allergy to iodinated contrast agents, along with characterizing lesions indeterminate at CT[3].

Renal parenchymal tumors include an extensive and heterogeneous array of expansile lesions, from benign or less aggressive lesions to extremely aggressive malignant tumors with mean survival of few months after the diagnosis. As a rule, 90% of renal parenchymal tumors are malignant, and about 90% of these are renal cell carcinomas (RCC).

Once confronted with an incidentally found solid renal parenchymal tumor, the radiologist should perform the lesion staging by MDCT or MRI, taking the following parameters into consideration:

- Tumor size: nodules < 4 cm present a higher probability of being benign (20%) or non-surgical (30%), while masses > 7 cm have a worst prognosis[4].
- Perirenal or sinus fat invasion, or invasion of adjacent organs: the MDCT and MRI accuracy in the detection of perirenal fat invasion achieves 90% provided specific analysis criteria are adopted[5,6].
- Renal vein and inferior vena cava invasion: positive and negative predictive values for vascular invasion are higher than 90% for both MDCT and MRI[2].
- Lymph nodes involvement: considering lymph nodes with less than > 1 cm in their smallest diameter as involved by a tumor, the methods sensitivity is > 95%, but the specificity is only 50%[2]. This scenario should face a considerable improvement with the commercial release of lymphotropic superparamagnetic iron-based contrasts, that have shown 100% sensitivity and 95% specificity in preliminary studies evaluating lymph node staging[7].
- Distant metastases: CT is the method of choice for detecting secondary lesions. Most frequent sites of metastatic involvement are: lungs, mediastinum, bones and liver.

The study published in the present issue of **RB**[8] brings a relevant aspect of renal cell carcinomas to attention: the probability of late tumor recurrence, months or even decades after the treatment of the primary lesion. Particularly, the article highlights the hypervascularized pattern of RCC pancreatic metastases and emphasizes the differential diagnosis with

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neuroendocrine pancreatic tumors. Two other relevant information can emerge from the reading of this article: the importance of an appropriate examination protocol, including an arterial or corticomedullary phase of the upper abdomen, and the necessity of long term oncological follow-up for patients with RCC.

Additionally, the treatment of RCC has undergone significant changes in the last years, with the development of nephron-sparing surgery techniques such as partial nephrectomy and enucleation. These surgical approaches can be utilized especially in patients with small, circumscribed and peripheral tumors, with recurrence rates similar to the ones observed in patients submitted to total nephrectomy[9]. Also, laparoscopic and robotic surgeries, minimally invasive percutaneous approaches (radiofrequency ablation and cryotherapy), and even watchful waiting in selected cases, constitute alternative methods for the management of RCC.

These therapeutic options currently available have created new paradigms in the imaging evaluation of renal tumors. Besides the staging itself, it is an attribution of the radiologist to give the urologist relevant information enabling an appropriate therapy planning or intraoperative management of lesions. Topographic details (such as distance between the lesion and the renal sinus, and hilar vessels involvement), and vascular details (presence of supernumerary arteries, congenital venous anomalies or peritumoral varices) should always be mentioned.

CT- or US-guided percutaneous biopsy of renal tumors, formerly discredited because of a theoretical risk for neoplastic dissemination along the biopsy needle track, has shown to be a safe and effective method, especially with the utilization of coaxial needles (dissemination risk < 0.01%), and combined fine needle-aspiration/core-biopsy techniques. Indications for biopsy of focal renal lesions include: patients with suspicion of renal lesion originating from a primary extrarenal neoplasm or infection; imaging findings suggesting an unresectable lesion, or presence of surgical comorbidity. Other emerging indications are: presence of a small (< 3) hyperattenuating, homogeneously enhancing renal mass, patients with renal mass considered for percutaneous ablation (radiofrequency or cryotherapy), or presence of complex, indeterminate cystic lesions (Bosniak III)[10].

Finally, recent studies have demonstrated the preoperative predictive values of CT or MRI regarding tumors aggressiveness or even histological subtype definition, particularly in relation to clear cell or papillary carcinomas. Usually, clear cell carcinomas present heterogeneous hypervascularization with necrotic foci, and may include microscopic fat detectable at MRI gradient-echo sequences with in-phase / out-of-phase images (MRI specificity for this histological subtype is 83%). On the other hand, papillary tumors typically present as homogeneous nodules, hypovascular, and hypointense on T2-weighted MRI sequences (94% specificity at MRI)[11]. These results are extremely promising, with great potential for application in patients with incidental lesions and candidates to minimally invasive therapies or close follow-up.

In summary, the technological development of imaging methods in the recent years, together with new therapeutic possibilities, have brought new paradigms to the imaging evaluation of renal parenchymal tumors.

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