Pitfalls in interpretation and diagnosing of small renal masses: how to avoid them

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Purpose

To analyze and characterize renal masses in order to avoid misunderstandings with the different imaging methods and mistaking in diagnosis.
Methods and Materials

We performed a retrospective review of patients with small renal masses between January 2011 and October 2011. All patients underwent ultrasound, RMI and multiphasic CT study including pre and postcontrast corticomedullary and nephrographic phases.
Results

With the new imaging techniques there was an increase in detecting parenchymal renal masses smaller than 3 cm. Their detection and characterization could be successfully performed by ultrasound, CT and MRI, bearing in mind that each of these methods has unique attributes. However, radiologists should be aware of the advantages and disadvantages of these techniques to understand how and when to use them, in order to avoid pitfalls in diagnosing.

Some of the problems are related to technical factors, but many others to errors in the interpretation of the images.

The main challenge in a routine ultrasound or CT examination is the differentiation of small benign multiple simple cysts from the less common solid renal neoplasm incidentally detected.

Most of the incidentally detected small lesions are renal benign cysts, but others are solid or cystic tumors, such as carcinomas, premalignant adenomas, oncocytomas and angiomyolipomas. In most of the cases, their characterization is easily accomplished with ultrasound, CT or both, but with lesions smaller than 1 cm, it may be more difficult.

There are many diagnostic errors that are mistaken as primary neoplasms, among them we can find anatomical variants, or pathological conditions from a different location, such as colon carcinoma. Otherwise, some neoplasms may be misdiagnosed as benign processes, for example a hemorrhagic cyst or a renal abscess (Fig. 2) when in fact it is a high density renal cell carcinoma (Fig. 3).

That is the reason why we will characterize the most important entities in order to arrive to more accurate diagnoses.

Pseudotumors

Pseudotumors are benign variants consisting of a prominent aggregate of normal renal tissue that appears mass-like, and they could be primary or acquired. To avoid any confusion with these entities, we must analyze the enhancement pattern after intravenous (iv) contrast agent administration, similar to the renal parenchyma.

Primary pseudotumors include hypertrophic column of Bertin and subcapsular nodules, which are easily recognized by CT or MRI, because although they appear as isodense or isointense masses on unenhanced scans, on the dynamic exploration they enhance like the renal cortex. Within primary pseudotumors, we must also include renal hilar lips, which are most often seen protruding from the medial border of the left kidney, and it
differs from the previous ones because it contains both cortex and medulla, these easily recognizable findings on dynamic scanning.

Acquired pseudotumors are characterized by a focal compensatory hypertrophy adjacent to an area of scarring from previous inflammatory disease. Not only iv contrast is useful when characterizing these entities, also are multiplanar CT or MRI reconstructions on different planes.

**Extrarenal processes**

Normal structures such as the spleen, colon, gallbladder, pancreas and adrenal due to its closeness to the kidneys, could simulate a primary intrarenal mass. In the same way, a pathological process in one of these organs can simulate a primary renal neoplasm (Fig. 4).

The most frequently entities found are those which an accessory splenic tissue, the medial lobe of the spleen or splenosis may mimic a renal mass. When this happens, the enhancement pattern with iv contrast is quite helpful in reaching an accurate diagnosis, because it is similar to the normal splenic tissue (Fig. 5).

**Inaccurate appearances**

Those processes that do not have a typical appearance make their benign or malignant characterization very difficult, such as complicated cysts (with hemorrhage or infection), abscesses, or necrotic tumors with low attenuation or bleeding, among others (Fig. 6).

In some cases, simple cysts which are located entirely within the renal contour may mistakenly simulate they have a thickened wall. Anyway, and bearing that in mind, any cystic lesion with water attenuation and a thickened wall with no uroseptic signs should be considered as malignant. Besides, cystic neoplasm´s attenuation is often slightly higher than the water, and it has irregular edges.

On the other hand, a renal cell carcinoma may cause a spontaneous retroperitoneal hemorrhage. Unfortunately, the detection of an underlying carcinoma could be difficult within a massive hemorrhage. Angiography is usually performed in this context, but many of these carcinomas are smaller than 1cm in diameter, becoming only identified by a pathologist. In the same way, renal infarcts may hide small associated tumors.

**Technical artifacts**
Considered as potential interpretation error sources are those technical artifacts such as kidney’s respiratory excursion, ensuing in a blurring of the renal contour and the consequent mistake of the radiologist to detect a renal mass at the poles, avoidable only if it is determined that each axial scan has anatomical relation with the location of the table (Fig. 7).

It should also be considered a non-uniform opacification of the inferior vena cava (IVC), simulating a thrombus or a tumor within the cava, avoiding it through a rapid peripheral iv injection of the contrast with a major flow, achieving a prior opacification of the renal veins than the IVC. Thus, the unopacified lower extremity blood creates a central lucency within the cava which is opacified peripherally at the level of the renal veins by the influx of contrast medium from the renal veins.

**Considerations about the different methods**

It should always be remembered that accuracy may be affected by the equipment’s quality besides the minutiae when performing the study.

Ultrasound results depend not only on the skills and training of the operator, but also the time and effort spent to carry out the examination. Furthermore, it should be thought about patient’s issues such as body habitus and internal anatomy.

Results on CT scans depend on the slice thickness, contrast media’s level in the tissues at acquisition time, and the capability of breathing maintaining of the patient. With multislice CT renal volume imaging is reached in a short period of time, not only avoiding respiratory artifacts, but allowing millimetric reconstructions.

The obtained information for detecting and characterizing renal lesions on MRI is the same or even superior to the one provided by CT scans, due to the quality of its images, and with fast sequences it may reach the acquisition in one breath only.

Like CT examination, iv contrast administration is essential to reduce the rate of misdiagnosis. Also, MRI is useful in patients’ follow up after renal neoplasms surgery resection, since it is often made between little interval of time and thus avoiding further irradiation.
Images for this section:

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Conclusion

US and CT are frequently complementarily used in small renal masses evaluation. Radiologists should be aware of the limitations of each method. When CT results are not conclusive, MRI is the modality of choice to characterize them.

Considering potential errors in renal masses’ diagnose helps to reduce unnecessary further studies and surgical procedures.

