Imaging techniques in the characterization of adrenal lesions

Técnicas de imagem na caracterização de lesões adrenais

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Currently, with the increasing utilization of sectional imaging methods, most adrenal masses are incidentally found during imaging investigation performed for other indications[(1,2)]. Non-functional adenomas constitute the majority of incidentally found adrenal masses. However, the suprarenal gland is also a common site of metastasis and less frequently primary tumors including myelolipoma, pheochromocytoma, and adrenocortical carcinoma[(1,2)].

The characterization of an adrenal lesion is critical for an appropriate management of the patient, and is fundamentally based either on the functional or non functional behavior of the lesion, in addition to its benign or malignant nature[(2,3)]. Functional adrenal lesions may be symptomatic, with typical clinical and laboratory features, like in many cases of cortical adenomas and pheochromocytomas, which makes their characterization easier[(2,3)]. The characterization of non functional adrenal lesions represents a major diagnostic challenge. Extensive lesions may cause symptoms, while smaller lesions are in general incidentally identified or found during staging procedures in cancer patients. In both situations, the characterization of the lesion is strongly based on imaging diagnosis techniques[(2,4,5)].

Fortunately, the advances achieved in the last years allow for a definition of the nature of most adrenal lesions. Computed tomography (CT), magnetic resonance imaging (MRI) and nuclear medicine techniques, including positron emission tomography (PET), may be employed, and all of such techniques are clinically useful in the differentiation of such lesions[(2–6)].

Stability is the simplest characteristic to be observed at imaging in order to define the nature of adrenal masses. The absence of growth determined by a simple analysis of previous images represents a consistent characteristic of benignity[(2–4,6,7)]. The nature of an adrenal lesion is also related to its dimensions; lesions with < 4 cm in diameter tend to be benign, and those above 4 cm in diameter present higher risk for malignancy[(2–4,6,7)].

CT and MRI techniques can also make the specific diagnosis of adenoma by taking advantage of the abundant amount of intracellular fat that is present in the majority of such lesions[(2–8)]. In a pioneering study published in 1991, Lee et al. reported that the radiological attenuation at CT might effectively differentiate adrenal adenomas from non-adenomatous lesions[(9)]. In a meta analysis, Boland et al. have demonstrated that, with a threshold of 10 Hounsfield units (HU), the test sensitivity for the diagnosis of adenoma would be 71%, and the specificity, 98%. In such a case, the high specificity takes precedence in order to avoid false negative results for malignancy[(10)]. Currently, 10 HU is the standard threshold adopted by radiologists to differentiate lipid-rich adenomas from other adrenal lesions at non-contrast enhanced CT[(2–4,6,7)].

However, up to one third of all adenomas have a reduced amount of intracellular fat, and thus present attenuation values higher than 10 HU at non-contrast enhanced CT, like almost all malignant lesions[(2,5,11)]. At MRI, the presence of intracellular fat may be detected by means of the chemical shift technique[(12)]. There is no significant difference between CT and MRI techniques for characterizing lipid-rich adenomas, but MRI may be superior in the evaluation of lipid-poor adenomas which present higher attenuation values (up to 30 HU) at CT[(2,5,11)].

Also, CT may characterize adrenal lesions upon attenuation measurements at different time delays after contrast injection. After intravenous contrast injection, adenomas tend to present faster enhancement washout than non-adenomatous lesions [(13–15)]. The relative washout percentage (RWP) represents the rate of decrease in density observed at the delayed phase in relation to the image acquisition at the dynamic phase following the iodinated contrast administration. With the value of attenuation at non-contrast enhanced CT, the absolute washout percentage (AWP) may also be calculated. Many studies have demonstrated that both calculations (RWP and AWP) allow for a highly accurate characterization of adrenal lesions, so such measurements are routinely utilized[(5,6,15)].

Radiopharmaceuticals may also be utilized in the characterization of adrenal lesions. Metaiodobenzylguanidine (MIBG) has been utilized for decades in the characterization of pheochromocytomas[(1,2)]. In the current practice, however, fluorodesoxyglicose (^{18}F-FDG) has been the most utilized radiopharmaceutical in the characterization of malignancy at PET/CT scans. In general, malignant nodules usually present increased FDG uptake. The results demonstrate sensitivity and specificity values > 90% in the differentiation between malignant and benign lesions with such technique[(2,16)]. PET/CT is less accurate to detect lesions < 1 cm, since small malignant lesions may not present significant contrast uptake[(2,16)].

In the present issue of **Radiologia Brasileira**, Melo et al. present an innovative study approaching a protocol of MR spectroscopy to evaluate adrenal masses, developed by the same group in a previous study[(17)]. In general MR spectroscopy of adrenal gland is a particularly challenging technique, principally because of the small size of lesions and also due to respiratory artifacts resulting from diaphragm motion[(5)].

The mentioned protocol allows for spatial localization of the adrenal gland by means of three sagittal sequences at expiration,

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inspiration and free breathing. In this most recent study comprising a larger sample including adenomas, carcinomas, metastases and pheochromocytomas > 10 mm, the authors have observed 100% sensitivity and 98.2% specificity utilizing the choline/creatine (Cho/Cr) ratio ≥ 1.20 to differentiate carcinomas/metastases from adenomas/pheochromocytomas. Such a metabolic ratio differentiates malignant from benign lesions with high accuracy and aids in the resolution of the most common enigma in the characterization of adrenal lesions, namely, the differentiation between benign adenomas and metastases in cancer patients. Additionally, the authors analyzed other metabolic ratios which allow for the establishment of distinctive standards for every studied adrenal lesion.

Thus, the authors demonstrate that it is possible to incorporate spectroscopy into the techniques for evaluation of adrenal masses, and that the metabolic ratios demonstrated by the spectroscopic charts may be useful in the differentiation of such lesions with high accuracy.

Several imaging diagnosis techniques allow for the characterization of adrenal lesions. Different investigation algorithms described in the literature seek to organize the utilization of such tools[2,3,5,18]. Continuous developments in MRI apparatuses have led to the inclusion of spectroscopy as a promising technique to be incorporated into the future investigation guidelines.

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