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Non-invasive evaluation of the incidentally detected indeterminate adrenal mass

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Clinically silent adrenal masses are discovered incidentally during diagnostic testing or treatment for clinical conditions that are not related to suspicion of adrenal disease; thus, they are commonly referred to as 'incidentalomas'. The widespread use of high-resolution anatomic imaging techniques such as computed tomography (CT) and magnetic resonance (MR) imaging has led to the increased detection of these masses. In many patients without a known extra-adrenal primary malignancy—and even in patients with a primary neoplasm—most adrenal masses ultimately prove to be benign. However, it remains important that these adrenal masses are accurately characterized to exclude the treatable causes of adrenal disease, and also to accurately stage the oncology patient. The purpose of this chapter is to describe the findings and recent advances in non-invasive imaging methods that are now available for the accurate characterization of incidentally detected adrenal masses (i.e. the differentiation of benign from malignant masses). The imaging techniques and the algorithms that are used in our institution for the evaluation of incidentally detected adrenal mass will be described.

Key words: incidentaloma; adrenal gland; adrenal gland neoplasm.

Clinically silent adrenal masses incidentally detected through routine imaging for causes other than adrenal disease, commonly referred to as adrenal incidentalomas, were first described more than 20 years ago.[1] Their prevalence approaches 3% in middle age, and increases to as much as 10% in the elderly.[2] In most patients without a known extra-adrenal primary malignancy, and even in patients with

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a primary neoplasm in whom an adrenal metastasis is suspected, most incidentally detected adrenal masses will ultimately prove to be benign.[3] However, it is important that these adrenal masses are properly characterized, especially in the oncology patient, as the presence or absence of metastases influences tumor staging. Diagnostic methods for determining the etiology of adrenal gland masses include endocrine evaluation and imaging studies—computed tomography (CT), magnetic resonance (MR), and nuclear scintigraphy—as well as needle biopsy.

Incidental adrenal masses can be benign or malignant. They include adenomas, adrenal cysts, haematomas, myelolipomas, ganglioneuromas, pheochromocytomas, adrenal cortical carcinomas, metastases from other cancers, and other rare entities.[4] Adrenal adenomas can be further subdivided into (a) functional or hypersecreting, and (b) non-functional, depending on whether or not they elaborate adrenal hormones such as aldosterone, cortisol or androgens.[5] A complete history and physical examination in addition to biochemical evaluation of all pertinent hormones will help confirm the diagnosis in cases of functional (clinical or subclinical) adrenal masses.[6] Radiological evaluation in these instances will be performed mainly for tumor localization prior to surgical removal. In non-functioning masses, additional testing—primarily using imaging studies and, if needed, needle biopsy—will be required for further evaluation and characterization.

IMAGING STUDIES

CT

CT is the most commonly used modality for the detection and in many centers, including our own, for characterization of adrenal masses. Up to 5% of abdominal CT scans obtained for reasons other than suspected functioning adrenal mass will demonstrate an adrenal mass.[2] Once detected, mass characteristics that are evaluated include mass size, homogeneity, and presence of fluid, fat, hemorrhage or calcifications. Most masses smaller than 4 cm appear to be benign; however, most studies have shown that size alone cannot be used to exclude malignancy.[6] Autopsy series show that less than 2% of adrenal adenomas are larger than 4 cm in diameter and less than 0.03% are larger than 6 cm, while 92% of adrenal cortical carcinomas are larger than 6 cm.[7] Since 25% of adrenal masses $>$ 6 cm are adrenocortical carcinomas, surgical resection is usually indicated.[4] Imaging findings such as the presence of fat, hemorrhage and fluid can at times be helpful in making a specific diagnosis, but only in a small percentage of cases. However, in most cases the imaging findings discussed above do not help in distinguishing between benign and malignant adrenal masses. In addition to the imaging evaluation, knowledge of the biochemical abnormalities in suspected cases of hypersecreting tumors and the presence or absence of an extra-adrenal primary neoplasm should also be taken into account when attempting to characterize the incidental adrenal mass.[8]

Differentiating benign adrenal adenomas from malignant masses using non-invasive imaging methods can reduce the need both for percutaneous adrenal biopsy in patients with cancer and the follow-up imaging of incidental adrenal masses.

Many studies have shown the usefulness of attenuation measurements or CT densitometry using unenhanced CT (prior to intravenous administration of contrast