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An Unusual Case of Adrenal Metastasis from Colorectal Cancer: Computed Tomography and Fluorine 18-Fluoro-Deoxy-Glucose Positron Emission Tomography-Computed Tomography Features and Literature Review

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Key Words

Adrenal metastasis · Colorectal cancer · ¹⁸F-FDG PET-CT · CT

Abstract

Incidentally discovered adrenal masses are a common diagnostic problem. While computed tomography (CT) and magnetic resonance (MR) imaging can adequately characterize most benign or malignant adrenal masses, in some cases the results are indeterminate. We report and discuss a case of an adrenal metastasis with misleading clinical and CT features, in which an abnormal metabolic uptake detected through fluorine 18-fluoro-deoxy-glucose positron emission tomography (¹⁸F-FDG PET)-CT raised the suspicion of adrenal metastasis relatively early compared with apparently normal results on repeated follow-up CT examinations.

Introduction

Incidentally discovered small adrenal masses, detected through imaging for nonadrenal disease, are a common diagnostic problem. The correct identification of their benign or malignant nature is of critical importance, especially in patients with a known malignancy, since it will obviously affect treatment and prognosis. We report and discuss

a case of an adrenal metastasis with misleading computed tomography (CT) features and clinical course, in which an abnormal metabolic uptake detected through fluorine 18-fluoro-deoxy-glucose positron emission tomography (^{18}F -FDG PET)-CT raised the suspicion of adrenal metastasis relatively early compared with apparently normal results on repeated follow-up CT examinations.

Case Presentation

A 66-year-old man came under our observation in 2007 for re-evaluation of a left adrenal mass. In January 2002, at the age of 61, he had undergone anterior resection of the rectum for adenocarcinoma at another hospital. At that time, as a part of the presurgical work-up, the patient had been submitted to contrast-enhanced CT examination, in order to detect distant metastases. A left adrenal mass with a diameter of 2.2 cm had been revealed ([fig. 1](#)). The smooth contours and homogeneous texture of the mass, with low attenuation values, had suggested that its nature was benign. Normal plasma levels of aldosterone and cortisol as well as urinary excretion of aldosterone and free corticoids had excluded adrenal cortex hyperfunction. Based on these features, a diagnosis of nonfunctioning adrenal adenoma had been made. The patient had undergone surgery, which had confirmed rectal adenocarcinoma (pT3pN0).

Subsequently, serial follow-up by means of clinical assessment and biochemical tests had been unremarkable until March 2006, when an increase in the carcinoembryonic antigen level was observed. Whole-body contrast-enhanced CT showed a large mass involving the superior and middle lobes of the right lung, which was thought to be metastatic. However, no modifications in size and attenuation values of the left adrenal mass were observed, thus confirming a benign mass based on the CT features. The patient underwent a right-lung bilobectomy, and pathologic examination of the resected lung confirmed a large metastasis of adenocarcinoma.

In November 2006, ^{18}F -FDG PET-CT, performed at another hospital, showed a high uptake of ^{18}F -FDG in the left adrenal mass, yet without any changes in size and overall appearance. Notwithstanding this abnormal uptake, based on the stability in size since 2002, the adrenal lesion was still considered as benign.

In July 2007, because of a rapid increase in carcinoembryonic antigen levels, the patient came to our attention. A ^{18}F -FDG PET-CT confirmed a high uptake of the metabolic tracer in the left adrenal mass, with a maximum Standardized Uptake Value (SUV) of 9.5. In addition, the lesion had markedly increased in size, and the diameter of the mass was now 4.5 cm, i.e. approximately doubled compared with the previous measurements ([fig. 2](#)). In order to exclude a possible pheochromocytoma, 1 month later scintigraphy with metaiodobenzylguanidine (MIBG) and laboratory investigations were performed. However, no scintigraphic alterations were found, nor did biochemical studies show elevation of urinary secretion of metanephrines and catecholamines, thus excluding the hypothesis of pheochromocytoma.

A subsequent contrast-enhanced CT confirmed the 4.5-cm lesion in the left adrenal gland: besides the increase in size, the lesion showed heterogeneous enhancement on post-contrast images and low-density internal areas, suggesting necrosis ([fig. 3](#)).

In January 2008, the patient underwent laparoscopic left adrenalectomy and histopathologic examination revealed adenocarcinoma, consistent with metastatic involvement from the primary rectal neoplasm.

Discussion

Incidentally discovered small adrenal masses are common; their prevalence in autopsy series ranges between 1.4 and 2.9% [1]. While CT and magnetic resonance (MR) imaging can adequately characterize most benign or malignant adrenal masses, in some cases the

results are indeterminate. In such instances, functional evaluation by means of ^{18}F -FDG PET-CT may contribute to a better characterization [2].

Concerning CT diagnosis, criteria which allow to discriminate between benign or malignant lesions include size, shape, density, and vascular enhancement pattern after administration of i.v. contrast medium [3]. Besides being usually small (<3 cm), rounded, and homogeneous, a common feature of adenomas is the presence of intracytoplasmic lipids. For this reason, unenhanced CT densitometry can be used to help differentiate adrenal adenomas from metastases: adrenal masses can be diagnosed as adenomas if they have a CT number of 10 Hounsfield units (HU) or less on unenhanced CT, with a sensitivity of 71% and a specificity of 98% [4]. On the other hand, after contrast medium administration, both adenomas and metastases enhance early, but adrenal adenomas typically wash out the contrast agent more rapidly than metastases; therefore the delayed attenuation values at 10–15 min after contrast administration can be used to differentiate adenomas from malignant masses [4]. With a combination of unenhanced and delayed enhanced CT, most adrenal masses can be correctly categorized (sensitivity 96–98%; specificity 61–92%, accuracy 81–96%) [3, 4].

Based on similar criteria, MR imaging can also evaluate the morphological and signal intensity features as well as the fat component of an adrenal mass, thus allowing to reliably differentiate benign from malignant masses in most cases, with an overall accuracy of 94% (89% sensitivity and 99% specificity) [5].

However, approximately 30% of adenomas are lipid-poor, and conversely small metastases appear frequently homogeneous on contrast-enhanced CT. Therefore, notwithstanding the abovementioned criteria, both on CT and MR studies the attenuation and signal intensity values as well as the morphological features of adenomas may overlap with those of metastases in 20–30% [2].

A few reports and studies in the literature have suggested that ^{18}F -FDG PET-CT is useful to differentiate benign from malignant adrenal lesions, with sensitivity and specificity ranging from 92 to 100% and from 80 to 100%, respectively [6–11]. Hemorrhage, necrosis, small size of the lesion, and metastases from non- ^{18}F -FDG-avid tumors – such as neuroendocrine tumors – are reported to be the most common causes of a false-negative scan. Conversely, mildly to moderately increased FDG uptake may occasionally be seen in benign lesions such as some pheochromocytomas and adenomas, with consequent false positive results. The degree of metabolic uptake of adenomas on PET-CT is in fact variable and has still not been analyzed thoroughly in the literature, although the functional state of adenomas is reported to be the principal factor determining the intensity of ^{18}F -FDG uptake [8].

Concerning PET-CT exams, there is still some debate about which is the best method for assessing adrenal ^{18}F -FDG uptake. For some authors, semiquantitative analysis performed by SUV and SUV ratio – i.e. adrenal nodule SUV/liver SUV – might be used to accurately differentiate benign from malignant adrenal lesions. Metser et al. [9] found that a SUV cutoff of 3.1 resulted in a sensitivity of 98.5% and specificity of 92% for differentiating adenomas from malignant lesions. Similar results were found by Brady et al. [10] by combining mean attenuation >10 HU and a maximum SUV >3.1 (97.3% sensitivity, 86.2% specificity, 90.5% accuracy). In contrast, Jana et al. [11] showed that there were no significant differences between visual interpretation and SUV measurement. According to Tessonier et al. [6], an adrenal ^{18}F -FDG uptake higher than

that of the liver on visual interpretation is considered suggestive of malignancy and more accurate than maximum SUV value alone.

In the current case, both the imaging features of the adrenal lesion and the clinical course were quite unusual. The mass remained absolutely stable in size and morphology for almost 5 years (from January 2002 through November 2006). Stability in size for more than 1 year of follow-up is usually considered a criterion of benign disease. Thus, only the first PET-CT examination revealed an unexpected finding, i.e. the increased metabolic uptake, whereas the CT findings were still unmodified. Indeed, the CT features on previous exams met all the morphological criteria of a benign lesion even at the time of the first abnormal ^{18}F -FDG PET-CT exam. Alternatively, the hypothesis of a metastasis occurring in an adrenal gland with a pre-existing adrenal adenoma (so-called ‘collision tumors’) cannot completely be excluded [12]. However, the presence of a slow-growing metastasis is more likely, due to the ^{18}F -FDG uptake demonstrated since 2006.

According to our experience from this case, in a patient with a known primary cancer further evaluation by means of image-guided biopsy should be considered for any nonhyperfunctioning adrenal mass showing an abnormal FDG uptake, notwithstanding the possibility that its CT features may appear benign, whenever early metastatic tumor recognition is clinically required. Percutaneous image-guided biopsy (by CT or less frequently by transabdominal ultrasound guidance) is an effective and widely accepted procedure for characterizing those lesions exhibiting ambiguous features that may remain indeterminate by imaging, with a reported accuracy of about 90% and a complication rate of about 2.8–4.3% [13]. Fine-needle aspiration biopsy of the adrenal glands under endoscopic ultrasound guidance has also been developed and represents an innovative application which appears to play an increasing role in the near future for the evaluation of adrenal lesions [14].

In patients with colorectal cancer, the clinical course and the prognosis may vary greatly (the 5-year survival rate ranges from 10 to 90%) depending on many factors, such as tumor node metastasis stage, histologic type, and tumor grade [15]. Although colorectal carcinoma is known to be generally less aggressive compared with other abdominal and gastroenteric (G.E.) tract tumors, the extremely slow progression of the metastatic tumor makes this case quite unusual. In fact, the adrenal metastasis not only exhibited benign features on serial CT scans performed from 2002 through 2006 but also remained stable in size for almost 5 years. PET-CT evaluation, instead, allowed the early detection of a functional abnormality – i.e. the increased metabolic FDG uptake – before any morphological change occurred, and eventually led to the correct diagnosis of adrenal metastasis.

Disclosure Statement

The authors certify that there is no actual or potential conflict of interest in relation to this article.

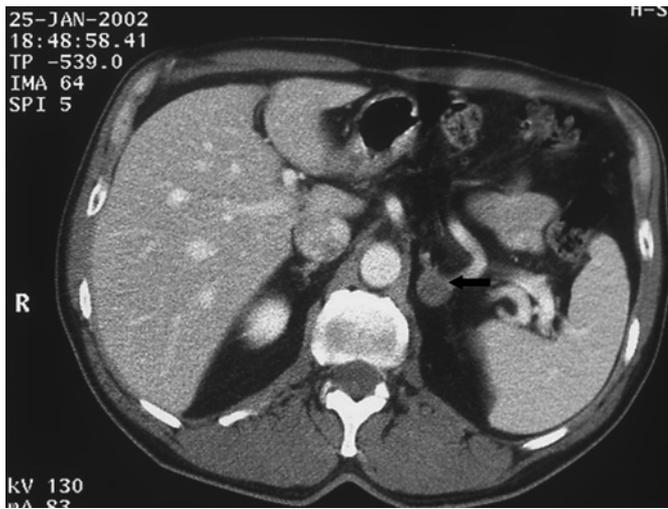


Fig. 1. Contrast-enhanced CT (January 2002). CT examination of the upper abdomen, in the portal phase of the study, shows a well-circumscribed rounded hypodense mass with a diameter of 2.2 cm in the medial portion of the left adrenal gland (arrow). The low attenuation and homogeneous texture of the mass, together with the small size and well-defined margins, are consistent with an adenoma by established CT criteria. The right adrenal gland is normal.

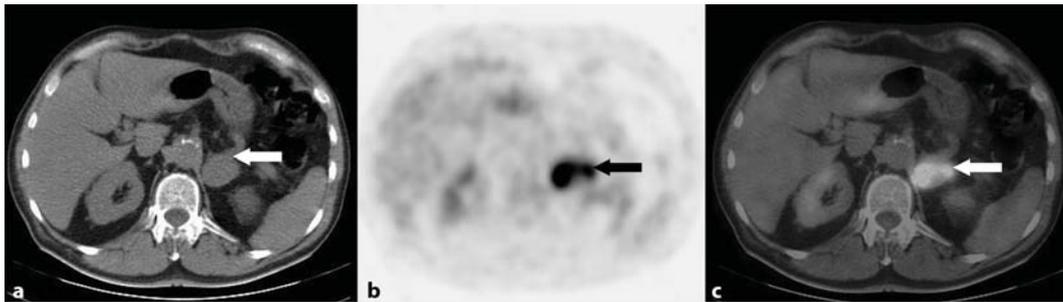


Fig. 2. ^{18}F -FDG PET-CT (July 2007). Unenhanced CT (a), ^{18}F -FDG PET (b) and fused images (c) show high ^{18}F -FDG uptake in the left adrenal mass (arrow), with a maximum SUV of 9.5. The lesion is markedly increased in size, measuring 4.5 cm, i.e. approximately doubled compared to previous measurements.

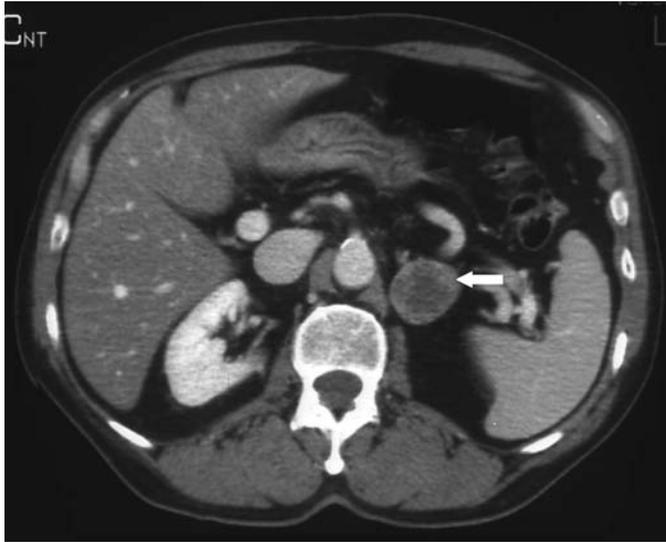


Fig. 3. Contrast-enhanced CT (December 2007). CT examination performed a few months later confirmed the presence of an irregular 4.5-cm lesion in the left adrenal gland (arrow), inhomogeneous with low-density internal areas suggesting necrosis, a finding that is most consistent with malignancy.

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