Adrenocortical Carcinoma: False Positive in an I-123 Metaiodobenzylguanidine Scan

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A 55-year-old man with a personal history of left pheochromocytoma 2 years previously presented with an abdominal mass. Tumor relapse was suspected. Abdominal ultrasound showed a large left upper quadrant solid mass (calipers), with heterogeneous echogenicity and central cystic degeneration areas or necrosis (Fig. 1a). A computed tomography (CT) scan showed surgical clips of left adrenalectomy and multiple confluent left upper quadrant masses with a maximal diameter of 19 cm and heterogeneous enhancement (Fig. 1b). Both CT scan and ultrasound images were suspicious of adrenocortical carcinoma (ACC): size, heterogeneity and diaphragm invasion among other radiological features. Clinically, the mass grew in a few months and there were no paroxysmal hypertension episodes, nor elevation of catecholamines (catecholamine urine test: 37.2 µg/g creatinine, normal range 0.1–260).

F-18 fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT was performed as ACC was suspected

(2). ACC is an uncommon malignant neoplasm of unknown cause; however, smoking and oral contraceptives may be risk factors [1, 2]. Patients usually present with advanced-stage disease and have poor prognosis [3], with a 2-year recurrence rate that ranges from 73 to 86 % [4]. CT or magnetic resonance (MR) is most often used for initial staging of ACC and usually shows heterogeneous adrenal mass with variable enhancement of solid components [4]. F-18 FDG PET has been used successfully for detection of adrenal metastases and for staging ACC [5]. Most ACCs accumulate and retain FDG [2, 6]. However, FDG PET cannot differentiate among malignant lesions (metastases, ACC, malignant pheochromocytoma, and lymphoma). Also, most pheochromocytomas (benign or malignant) are metabolically active and might accumulate FDG [7, 8]. A whole-body FDG PET scan (coronal and axial view) shows increased irregular FDG uptake in the abdominal masses (Fig. 2).

An I-123 metaiodobenzylguanidine (MIBG) scan was requested to rule out pheochromocytoma because, although conventional image methods (ultrasound and CT) and also PET/CT scan were suspicious of ACC, the primary histology of the tumor was consistent with pheochromocytoma. An MIBG scan was performed after injection of 185 MBq of I-123 MIBG intravenously. Single photon emission tomography (SPECT)/CT scan showed abnormal isotope accumulation in the tumor region. The patient underwent total resection of the tumor. The histology was of ACC, with areas of necrosis and cystic areas, so the result of the MIBG scan was a false positive. No positive chromaffin staining or chromogranin

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Fig. 1 **a** Abdominal ultrasound showing a large left upper quadrant solid mass (calipers), with heterogeneous echogenicity and central cystic degeneration areas or necrosis. **b** CT scan (axial view, contrast

enhanced) showing surgical clips of left adrenalectomy (arrow) and multiple confluent left upper quadrant masses (arrowheads)

expression was found. Biopsy of the left adrenalectomy was re-evaluated from the archive and confirmed an ACC (Fig. 3).

MIBG is a guanetidine analog structurally similar to norepinephrine. It is recognized by type I uptake mechanism and stored in the catecholamine storage vesicles and has been used to image adrenal medulla and sympathomimetic tissues. MIBG scintigraphy has demonstrated 87 % sensitivity and 99 % specificity for detection of pheochromocytomas [8].

There are a few reports of false-positive MIBG studies. Horne et al. [9] described three cases of false-positive MIBG studies (one was an ACC). Letizia et al. [10] and Rainis et al. [11] reported another ACC with MIBG uptake. These latter authors divided false-positive MIBG studies into three categories. The first category is neuroendocrine lesions other than pheochromocytomas (tumors of the APUD series). The second category consists in adrenal lesions other than

Fig. 2 F-18 FDG PET/CT scans

Fig. 3 MIBG and SPECT/CT (axial, coronal and sagittal views) scans

pheochromocytomas (adenomas, ACC). The reasons for this abnormal uptake are unclear. The third category consists of tracer uptake adjacent to the adrenal due to abnormalities in the route of excretion.

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Conflict of Interest Cristina Rodríguez Rey, Aída Ortega Candil, Eliseo Vañó Galván, María Nieves Cabrera Martín and José Luis Carreras Delgado declare that they have no conflicts of interest.

Ethical Statement The authors referred this case to the President of the Ethical Committee of their Hospital prior to writing this report. She declared that it was not necessary to request a written informed consent from the patient because the patient had already been informed verbally that the case could be published. The President of the Ethical Committee also considered that the case accords with the 1964 Declaration of Helsinki.

Not Published Before The authors declare that the content of this manuscript has not been published before and is not under consideration for publication anywhere else.

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