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CASE REPORT

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Integrated Imaging Characterization of Adrenal Adenoma: False-Positive Metaiodobenzylguanidine (MIBG) Findings of Adrenal Scintigraphy

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

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Summary

Background: Evaluation of a patient with melanoma in whom an adrenal mass was detected on CT and MR during follow-up and further characterized with PET-CT and MIBG scintigraphy.

Case Report: In this case report, we describe a patient with melanoma in whom an adrenal mass was detected on CT and MRI during post-surgical follow-up and was further characterized with radionuclide studies consisting of PET-CT and MIBG scintigraphy. Although the results of imaging studies suggested that the mass was a pheochromocytoma, a cortical adrenal adenoma was histologically proven.

Conclusions: Integrated structural and functional imaging is recommended to characterize adrenal tumors; however, mistakes may occur and therefore careful imaging evaluation is required.

MeSH Keywords: 3-Iodobenzylguanidine • Adrenal Cortex • Adrenocortical Adenoma • Magnetic Resonance Imaging • Pheochromocytoma • Tomography Scanners, X-Ray Computed

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Background

Melanoma is an aggressive and highly metastatic tumor arising from pigment cells – melanocytes. The 5-year survival rate is lower than 15% in patients with systemic dissemination. Adrenal metastases may frequently occur and are clinically silent [1,2]. The diagnostic protocol during the follow-up of patients affected by melanoma usually involves CT and/or PET-CT imaging [3].

We describe a patient with melanoma who was evaluated in our diagnostic imaging department during post-surgical follow-up and in whom an adrenal mass was detected on CT. The results of imaging studies suggested that the mass was a pheochromocytoma, but a cortical adrenal adenoma was histologically proven.

Case Report

A 48-year-old woman with melanoma (stage IA), located on the back of the right foot and measuring 1.4 mm, was studied in our department. The patient was disease-free from her primary tumor and no other clinical abnormalities were revealed. However, a left-sided adrenal mass was detected on CT imaging, which was a solid nodular, hypodense mass in the posteromedial arm of the left adrenal gland (18 mm). The lesion was hypervascular with sharp and regular edges (Figure 1). Furthermore, the mass showed densitometric characteristics suggestive of an atypical adrenal adenoma, since the density value of 45 HU was measured on a pre-contrast CT scan. However, post-contrast dynamic CT images showed a significant contrast enhancement without substantial washout during the delayed phase (absolute washout=5%), suggesting

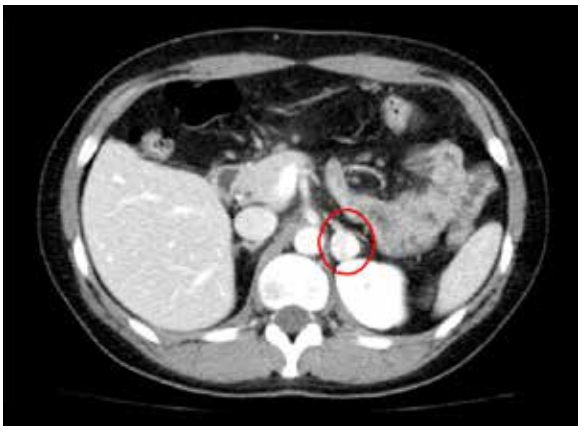

Figure 1. Abdominal, contrast-enhanced CT scan: a solid (18 mm) left adrenal mass with regular margins is detected.

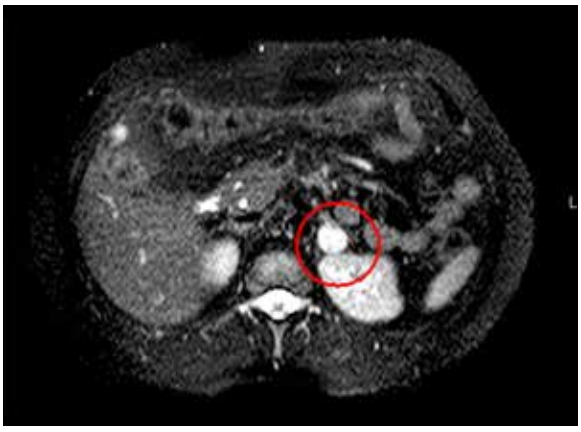

Figure 3. T2, TSE, SPAIR image showing the hyperintense nodular lesion.

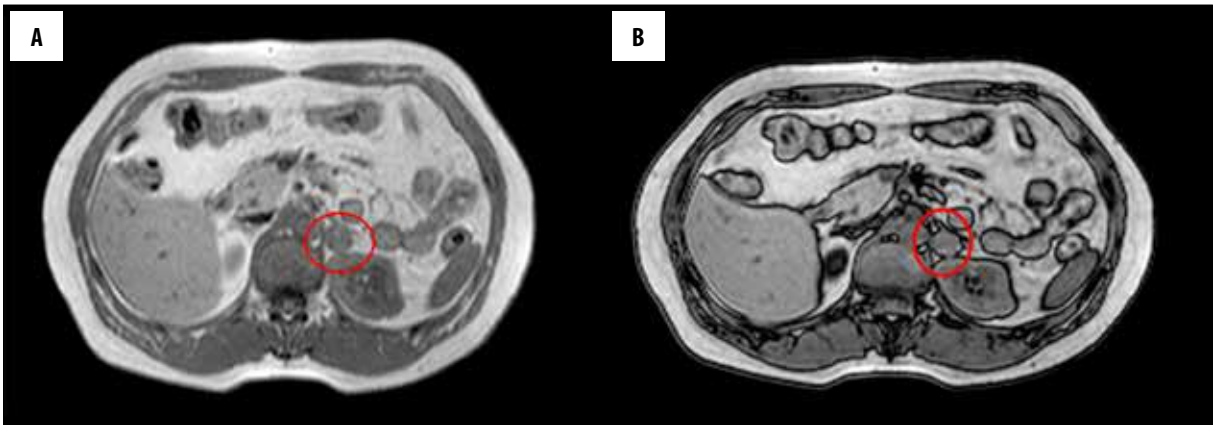

Figure 2. T1, chemical-shift in-phase (**A**) and out-of-phase (**B**): a round, left adrenal mass without signal intensity loss is showed.

a non-adenoma lesion. To further characterize the adrenal mass, magnetic resonance imaging (MRI) was performed using a dedicated protocol for adrenals. The chemical-shift sequence (CS) showed no significant reduction in signal intensity with a CS index of 0.7% (Figure 2A, 2B). On T2, TSE and SPAIR images, the mass was hyperintense (Figure 3); the dynamic post-contrast MRI sequence showed a comparable result to CT. On the basis of the results of CT and MRI, the diagnostic suspicion was raised for a non-adenomatous solid nodular mass. The neoplastic history of the patient suggested a possibility of a metastatic lesion. For this reason, the patient underwent PET-CT with FDG which showed a slight and unclear tracer uptake (SUV max 3.1) in the left adrenal space (Figure 4), with fusiform morphology that did not perfectly match the nodule but was probably characteristic of a normal adrenal gland. Thus, the malignant nature of the lesion was doubtful. For a further diagnostic characterization of the lesion, the patient underwent laboratory evaluation of adrenal function (Table 1); the only abnormal laboratory value was the level of urinary metanephrines that was measured three times for confirmation. Due to the suspicion of a "silent" pheochromocytoma, medullary adrenal scintigraphy with I^{123}-MIBG was performed on which intense, focal, tracer uptake in the left adrenal nodule was found (Figure 5). Thus, according to laboratory data and MIBG findings, the diagnosis of pheochromocytoma was made for the adrenal mass. For this reason, the patient underwent surgical resection of the left adrenal nodule, but histology demonstrated a cortical adenoma and the result of MIBG scintigraphy was considered as false-positive.

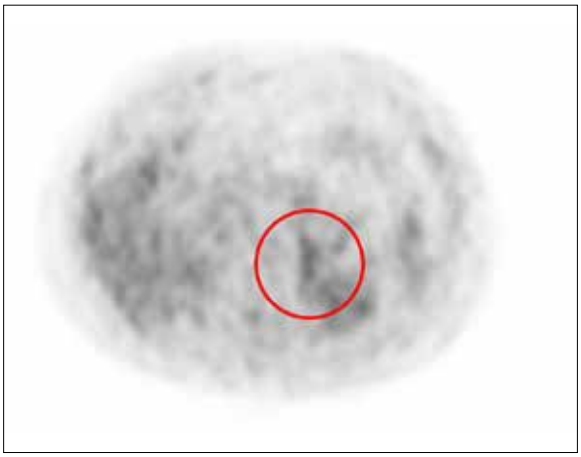

Figure 4. PET-CT with FDG shows a faint linear tracer uptake (SUV max 3.1) in the left adrenal space without focal morphology.

Discussion

In this report, we describe a case of a false-positive MIBG scintigraphy finding in which we observed a significant

Table 1. Laboratory results of adrenal function.

Cortical funcion		
Cortisol	119.8 ng/dL	Normal range 62–194 ng/dL
ACTH	10.8 pg/mL	Normal range 4.7–48 pg/mL
Aldosterone	13.2 µIU/mL	Normal range 2.44–44.5 µIU/mL
Medullary function		
Urinary cathecolamine	38 mcg/24 h	Normal range 0–115 mcg/24 h
Urinary metanephrine	Normal	Normal
Urinary nor-metanephrine	**811 mcg/24 h (day one)** **642 mcg/24 h (day two)** **675 mcg/24 h (day three)**	**Normal range 162–527 mcg/24 h**
VAM	4.7 mg/24 h	Normal range 1.8–6.7 mcg/24 h
Dopamine	31 mcg/24 h (day one) 130 mcg/24 h (day two) 217 mcg/24 h (day three)	Normal range 8–498 mcg/24 h

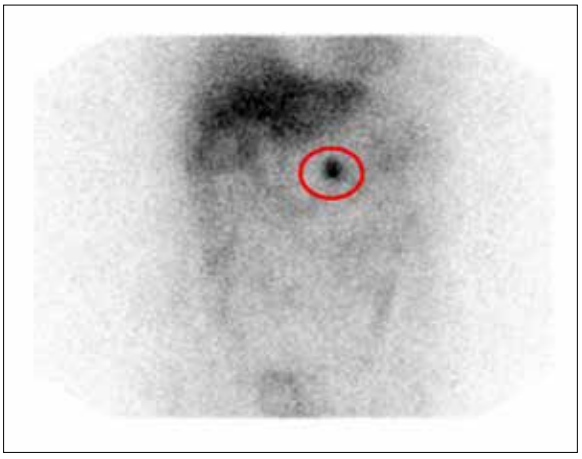

Figure 5. Adrenal scintigraphy with I^{123}-MIBG (anterior view) shows a focal tracer uptake in the left adrenal bed where the nodular mass was detected.

tracer uptake in a left adrenal nodule consisting of cortical adenoma. The patient was evaluated during a post-surgical follow-up for melanoma.

The imaging characterization of adrenal tumors is a clinical topic in routine diagnostic evaluation of patients with adrenal masses [4]. In this setting, the differentiation between benign and malignant lesions as well as between cortical and medullary tumors is fundamental for patient management and for selection of appropriate diagnostic and/or therapeutic protocols. For this purpose, there are CT and MRI criteria consisting of CT densitometry and post-contrast dynamic features as well as MRI pre- and post-contrast signal intensity characteristics [4]. Furthermore, radionuclide techniques with specific radiopharmaceuticals are able to specifically identify adrenal cortical adenomas, pheochromocytomas and malignant adrenal tumors, both primary and metastatic [5]. In particular, MIBG scintigraphy is the appropriate nuclear modality to characterize pheochromocytomas [6]. However, many cases of false-positive findings of MIBG scans have been reported in the literature [7–12]. Similarly, we observed in our patient another case of MIBG uptake in an adrenal cortical adenoma leading to an imaging misdiagnosis of pheochromocytoma. In particular, in two studies [8,9], similar false-positive results of MIBG imaging are reported in adrenal adenomas showing intense tracer uptake. Furthermore, two other cases of adrenal adenomas with MIBG accumulation have been reported in the literature, as previously mentioned [8]. In these cases, different explanations have been provided such as the coexistence of medullary hyperplasia and of dense medullary granules within the nodule.

Currently, the imaging characterization of adrenal tumors is performed by integrating the results of anatomic techniques, such as CT and/or MRI, with functional radionuclide modalities. In this setting, the proposal of hybrid, combined imaging, such as PET-TC or PET-RM, represents state of the art [13,14]. In our patient, the results of CT and MRI were suggestive of a non-adenoma adrenal tumor suspicious of pheochromocytoma, since pre-contrast CT densitometry revealed a value of 45 HU and a significant CT contrast enhancement with no wash-out was observed. Similarly, MRI features consisting of no signal intensity loss of CS, hyperintensity on T2-weighted images and post-contrast dynamic characteristics comparable to CT were suggestive of pheochromocytoma. Because of these imaging features and due to the abnormal urinary levels of metanephrines, the patient underwent MIBG scintigraphy that showed intense tracer uptake by the adrenal mass. However, the histology demonstrated a cortical adenoma and thus MIBG finding was a false positive. Furthermore, considering CT and MR imaging features of the adrenal tumor, the mass was considered as a non-adenoma lesion, since no low CT density as well as MR, T1, CS signal intensity loss were observed. Similarly, no significant wash-out in the mass was found both on CT and MR images.

Conclusions

False-positive results of MIBG may occur in cases of cortical adrenal adenoma as reported in the literature and in this case report. Moreover, CT and/or MRI images may lead to tumor misdiagnosis, since adrenal adenomas may have atypical appearance on CT and/or MRI imaging. Therefore, although integrated structural and functional imaging is recommended to characterize adrenal tumors, mistakes may occur and therefore careful imaging evaluation is required.

Conflicts of interest

None.

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