Unlikely Cohabitants: A Collision Tumor of Metastatic Small Cell Lung Carcinoma and Adrenal Adenoma

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Keywords

Collision Tumor, Small Cell Lung Cancer, Adrenal Adenoma

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Conflict of Interest Statement

The authors have no conflicts of interest to disclose in relation to this publication.

CASE REPORT

Unlikely Cohabitants: A Collision Tumor of Metastatic Small Cell Lung Carcinoma and Adrenal Adenoma

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Abstract

This case report is the second known publication of a very specific collision tumor, where small cell lung cancer metastasized to an adrenal adenoma. The focus is primarily on multimodal radiologic findings of the developing neoplasm, including CT, MRI, and FDG PET/CT. These findings are compared with established diagnostic criteria for adrenal adenomas and metastases, as identified by the literature and content expert review. Epidemiological data regarding collision tumors is discussed, as well as proposed treatment strategies. Similar topics are elucidated for small cell lung carcinoma. Reporting of this collision tumor adds to the relatively thin body of knowledge of these unique oncologic phenomena; allowing for potential future advancements in both diagnosis and management.

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1. Introduction

A collision tumor is a combined neoplasm where two different cell lineages make contact, but maintain distinct histological borders and unique tissue behavior. Collision lesions are categorized as a combination of either benign-benign, benign-malignant, or malignant-malignant tissues.[1] This case represents an example of a benign-malignant lesion, where small cell lung cancer (SCLC) metastasized to a pre-existing benign lipid-rich adrenal adenoma. To date, we are aware of only one published case of this specific collision tumor in the literature.[2]

2. Case Presentation

A 69-year-old female underwent a contrast-enhanced CT abdomen and pelvis due to unexplained weight loss. There was a remote history of breast cancer. She had a known left adrenal adenoma that was initially detected on CT 10 years prior; at that time the adenoma measured 3.0 cm with an attenuation of −5 Hounsfield Units (HU), (Fig. 1). During the 10 years subsequent to its finding, it remained stable in size and density. No specific studies were performed to assess adrenal insufficiency or function of the adenoma. However, in those 10 years there were also no electrolyte derangements or subjective patient complaints that might require that specific investigation. After 10 years of stability, the CT prompted by her weight loss revealed that the adenoma had increased in size to 5.2 cm and developed heterogeneity where previously uniform (Fig. 2).

MRI was performed to further define the lesion in response to its evolving characteristics. This showed two distinct intensities in the adenoma on dual echo

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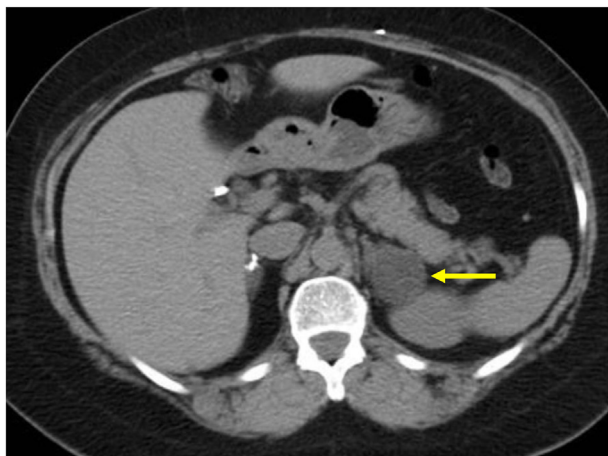
Fig. 1. Baseline axial CT abdomen without contrast 10 years prior to malignant findings. There is a 3.0 cm hypodense lesion in the left adrenal gland measuring <10 Hounsfield units, highly specific for a lipid-rich adrenal adenoma (yellow arrow).
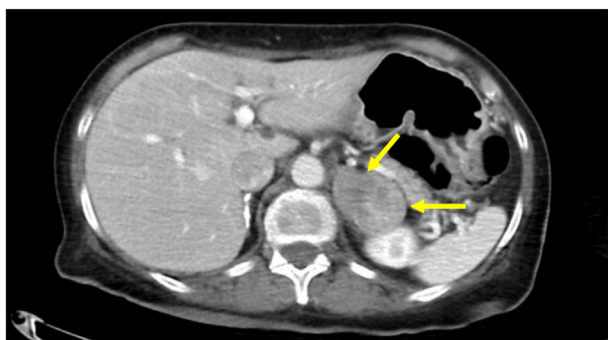

Fig. 2. Axial CT abdomen with contrast at time of small cell lung cancer staging. The adrenal lesion has increased in size with two new hypo-enhancing regions along the anterior and lateral aspects (yellow arrows).
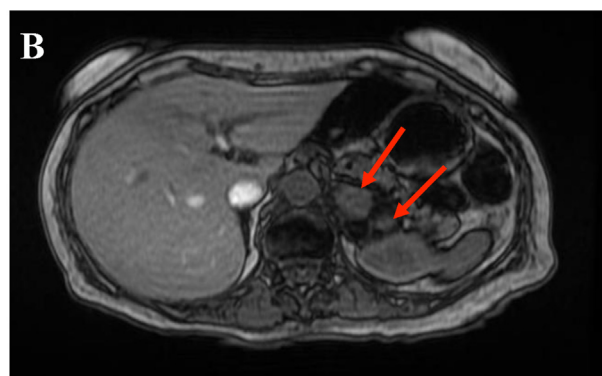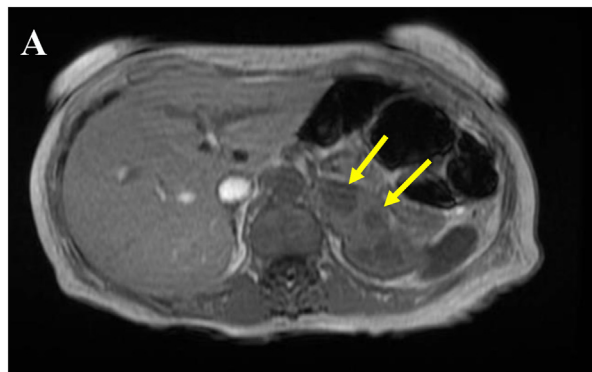

Fig. 3. 2D Dual Echo axial MRI without contrast, with in-phase (A) and out-of-phase (B) sequences. The pre-existing benign left adrenal adenoma demonstrates signal loss on out-of-phase images, representing internal fat content. Two new metastatic nodules (yellow and red arrows) do not demonstrate the same signal loss on out-of-phase images and represent a different cellular type.

sequences. Regions of signal drop on out-of-phase images represented the pre-existing lipid-rich adenoma, but two new internal foci without signal drop out were considered a new cellular type. This appearance was compatible with the development of a collision tumor within the adrenal adenoma, with two new internal metastatic foci of unknown primary origin (Fig. 3A and B).

Fluorodeoxyglucose (FDG) PET/CT demonstrated the new adrenal foci to be hypermetabolic (SUV 7.8), but also revealed hypermetabolic paratracheal, subcarinal, and left hilar lymph nodes (Fig. 4A and B). The SUV of the liver was 2.5, resulting in an SUV ratio of 3.1 (the adrenal lesions had 3.1 times the FDG uptake as the normal liver). An adrenal biopsy was attempted, but unfortunately was non-diagnostic. However, an Endobronchial Ultrasound-guided Transbronchial Needle Aspiration (EBUS-TNA) of the upper paratracheal and interlobar nodes identified SCLC. Based on imaging characteristics in addition to biopsy findings, the hypermetabolic left adrenal lesions were presumed metastatic. The patient was then diagnosed with extensive stage SCLC.

3. Discussion

Adrenal incidentalomas are common findings on cross-sectional imaging. They have varying reported prevalence, but have been identified at autopsy in 2.3% of the general population with adenomas accounting for the majority (54%−75%).[3] The imaging characteristics of adrenal adenomas are well-proven. On CT, they are typically <3 cm, round, homogenous, with smooth borders.[4] A cutoff of <10 HU categorizes lipid-rich adrenal adenomas with sensitivity of 71% and specificity of 98%. This allows few false positives and mitigates the need for unnecessary biopsy.[5] MRI identifies adrenal adenomas utilizing two characteristics of chemical shift. Firstly, visible intensity loss between in- and opposed-phase images is suggestive. Secondly, subtraction imaging will show retained signal intensity within the
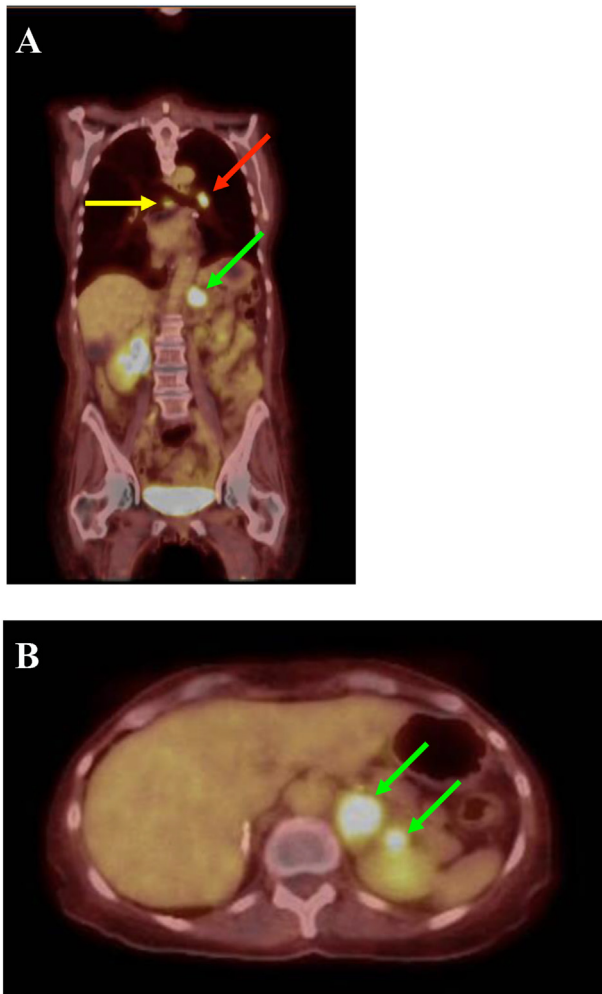
Fig. 4. FDG PET/CT Fusion Images, Standard Uptake Values (SUV) >/= 2.5 are considered suspicious for malignancy A. Coronal view demonstrating hypermetabolic sites of metastases involving a left hilar lymph node, SUV 10.4 (red arrow), subcarinal lymph node, SUV 4.9 (yellow arrow), and left adrenal gland, SUV 7.8 (green arrow). B. Axial view demonstrates two distinct hypermetabolic foci within the left adrenal gland (green arrows) in the same configuration as the abnormalities seen on CT and MRI, compatible with metastases into the pre-existing left adrenal adenoma.

adenoma.[6] FDG PET/CT is useful for discriminating between benign adrenal lesions and metastases. Proposed SUVmax cutoffs for metastasis range from 2.3 to 5.2.[7] However, it has been proven more useful to compare the SUVmax of the adrenal lesion with the SUVmean of the liver, also known as the SUV ratio. SUV ratio cutoffs for adrenal metastasis range from 1.0 to 2.5, meaning that FDG uptake within the adrenal lesion is greater than liver FDG uptake.[8,9]

This patient's prolonged and unique presentation required a significant amount of imaging to accurately work-up. Especially due to the discovery of presumed metastatic lesions without a known primary source. By and large, the studies requested were appropriate according to American College of Radiology (ACR) guidelines. However, retrospectively, it is apparent that the MRI obtained was an unnecessary utilization of resources; as this patient qualified for two different scenarios that obviated its need. According to ACR White Paper algorithms, both the size of the adrenal mass (>4 cm) and the patient's remote cancer history necessitated either biopsy or PET/CT. There were roughly 2 months between the CT that identified the evolving adrenal neoplasm and the PET/CT that showed malignant uptake. Some of this time would possibly have been saved from bypassing the MRI.[10] Biopsy can often be deferred in the setting of hypermetabolic adrenal metastases on FDG PET/CT; however, in this case biopsy was still pursued after the PET/CT since the primary tumor site was not yet known and the patient had a remote history of breast cancer.

Despite a non-diagnostic adrenal biopsy, this patient's imaging is suggestive of the development of a collision tumor. The original 3 cm round nodule measured −5 HU, was homogenous and was stable for roughly 10 years; these are confident characteristics of an adenoma. Within this adenoma two new nodules developed that were hypermetabolic on FDG PET/CT with an SUV ratio of 3.1, had heterogenous contrast enhancement on CT, and maintained signal on opposed-phased MRI; these are all imaging characteristics inconsistent with an adenoma. Therefore, overall findings were compatible with collision tumor formation, with metastases into a pre-existing adrenal adenoma.

Epidemiological data regarding collision tumors as a whole have not been established due to wide histologic variance in the types of tissues involved. In one study, 104 patients with primary malignancies in addition to adrenal masses were evaluated with MRI and 2 (2%) were identified to have collision tumors.[11] A specific review of adrenal collision tumors found that an adenoma was involved in a vast majority, 9 out of 11 cases.[2] Management strategies of collision tumors have similarly been poorly elucidated, however it has been logically suggested to base the treatment regimen on the more aggressive of the neoplasms.[1]

This patient's advanced presentation is typical for SCLC. Unfortunately, two-thirds of patients will have metastasis at diagnosis.[12] SCLC is classified by two stages, limited or extensive. Limited stage SCLC is disease confined to the ipsilateral hemithorax, with all affected lymph nodes accessible from one radiotherapy port. Extensive stage SCLC is essentially everything not classified as limited; including distant metastasis, malignant effusions, or contralateral supraclavicular/hilar nodal involvement.[13] Based on metastasis to the left adrenal gland and nodal spread,

this patient was considered extensive stage. The standard of care for extensive stage is a combination of an Anti-PD-L1 antibody and platinum-etoposide.[14] At the time of writing, this patient had completed three courses of Carboplatin, Etoposide, and Atezolizumab. Sadly, goals of care were palliative as an eight to ten month life expectancy was predicted.

The other reported case of a collision SCLC to adrenal adenoma was a younger (47-year-old) female patient with similar multimodal characteristics on imaging. She was treated with six courses of etoposide-cisplatin, adrenalectomy, then three more courses of chemotherapy. This approach gave her 12 disease free months, but she ultimately developed pancreatic metastasis and succumbed 2 years after the initial diagnosis.[2]

Scholarly reporting of these infrequent neoplasms is paramount to improving outcomes for the afflicted. Familiarization with the concept and imaging appearances of adrenal collision tumors can help avoid diagnostic dilemmas and aid in timely diagnosis and accurate staging. In addition to the need for establishing gross epidemiological data, there is also a need to define treatment strategies for the many varying types of collision tumors. Currently, oncologists and surgeons are not well-guided in these scenarios. As data regarding treatments and outcomes of collision tumors continues to be shared, better-informed decisions can be made and guidelines can be established.

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Author contributions

(I) Conception and design: Michael DeMeritt, Joel Thompson. (II) Administrative support: Joel Thompson. (III) Provision of study materials or patients: Joel Thompson. (IV) Collection and assembly of data: Michael DeMeritt, Joel Thompson. (V) Data analysis and interpretation: Michael DeMeritt, Joel Thompson, Stefan Johnson, Kevin Lightner. (VI) Manuscript writing: All authors. (VII) Final approval of manuscript: All authors.

Conflicts of interest

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