¹⁸F-FDG PET/CT detects Metastatic Renal Cell Carcinoma Masquerading as Primary Breast Malignancy

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Received: 26 September 2018 / Revised: 16 October 2018 / Accepted: 18 October 2018 / Published online: 27 October 2018
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Abstract

We present the case of a 36-year-old woman who underwent ¹⁸F-FDG PET/CT with suspicion of a primary breast malignancy. However, PET/CT detected an occult renal cell carcinoma with metastases to the thyroid, breast, lungs and lymph nodes. Thyroid and breast metastases are atypical metastatic sites of renal cell carcinoma. Breast metastases from extra mammary tissue are extremely rare, more so from renal cell carcinoma. Histopathologic confirmation of the breast lesions is imperative to avoid unnecessary mastectomy and imaging can help in raising the suspicion of metastatic involvement versus primary breast malignancy.

Keywords Breast metastases · Thyroid metastases · Renal cell carcinoma · Atypical metastasis

Renal cell carcinoma (RCC) represents approximately 5% of all new cancers being diagnosed in men and 3% in women [1]. Clear cell type of RCC is the most common histologic variant which also bears the highest risk of metastases [2]. Since the kidneys are retroperitoneal in their location, renal masses can grow substantially before they can become clinically evident. Hence, these patients are more likely to present with metastatic disease rather than with the isolated primary tumor. Sites of metastases from RCC include lungs, bones, lymph nodes, liver, adrenals and brain in decreasing order of frequency [3]. Atypical sites of metastatic RCC include peritoneum, retroperitoneum, muscles, pleura, pancreas, spleen, urethra

and ovaries [3–7]. Breast metastases from extra mammary tissue are extremely rare, with an estimated incidence of 0.5–2%, occurring in melanomas, lymphoma and leukemia [8, 9]. Metastases to the breast from RCC are even exceptional and documented only in few case reports [8, 10–12]. The present case presenting initially as a primary breast malignancy was diagnosed with an occult, metastatic RCC on ¹⁸F-FDG PET/CT. This case also had two highly uncommon and atypical sites of metastases in the thyroid and breast (Figs. 1, 2, and 3) [13]. ¹⁸F-FDG PET/CT thus helped in detection of the primary RCC, therefore avoiding unnecessary surgery on the metastatic sites and altering the management plan.

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Fig. 1 A 36-year-old woman presented with a painless lump in the left breast for 4–5 months. She underwent a mammogram which was suggestive of a Breast Imaging Reporting and Data System (BIRADS) category 4 lesion. Fine needle aspiration (FNA) of the lesion was suggestive of a malignant etiology. The patient subsequently underwent ^{18}F -FDG PET/CT for disease assessment and initial staging. Maximum intensity projection image (**a**) showed two foci of intense tracer uptake in the anterior thoracic region with mildly increased tracer uptake in the left hemithorax,

few foci in the bilateral thorax, and inhomogeneous tracer activity in the left upper abdomen. Coronal CT (**b**, arrow) and fused PET/CT (**c**, arrow) images revealed increased tracer uptake in the periphery of an enhancing solid-cystic mass (measuring approximately $15 \times 10 \times 17$ cm, SUVmax 10.8) seen to arise from the superior pole of the left kidney. The mass had central necrosis with multiple internal septations and was categorized as a Bosniak type 4 cyst, suggestive of a malignancy

Fig. 2 Trans-axial PET (**a**), CT (**b**, thick, white arrow), and fused PET/CT (**c**, thick, white arrow) images of the thorax showed an FDG avid well-defined enhancing soft tissue lesion in the left breast (SUVmax 3.6). Trans-axial PET (**d**), CT (**e**, thin, white arrow), and fused PET/CT (**f**, thin, white arrow) images of the neck showed increased tracer

uptake in a well-defined hypodense nodule in the right lobe of thyroid (SUVmax 4.4). Additionally, multiple FDG avid parenchymal nodules (SUVmax 4.4) were also noted in both the lung fields with FDG avid enlarged mediastinal, axillary and abdominal lymph nodes

Fig. 3 Based on the imaging findings, a core biopsy from the breast lesion was obtained. Histopathology (**a**, H&E $\times 200$) showed tumor cells arranged in nests and tubules with clear cytoplasm. Immunohistochemistry showed tumor cells positive for vimentin (**b**, $\times 200$), panCK (**c**, $\times 200$), and CD10

(**d**, $\times 200$) and negative for GATA3, ER, and PR. This confirmed the diagnosis of metastatic clear cell renal cell carcinoma. Fine needle aspiration (FNA) obtained from the thyroid nodule also was suggestive of metastatic involvement from renal cell carcinoma

Compliance with Ethical Standards

Conflict of Interest Ashwin Singh Parihar, Bhagwant Rai Mittal, Shelvin Kumar Vadi, Rajender Kumar, Kaniyappan Nambiyar, Bishan Radotra, and Lileswar Kaman declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study formal consent is not required.

Informed Consent The institutional review board of our institute approved this retrospective study, and the requirement to obtain informed consent was waived.

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