Interesting images

Simultaneous visualization of FDG avid and non-avid metastases in renal cell cancer

Visualización simultánea de metástasis con y sin captación de FDG en carcinoma de células renales

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A 56-year-old man with a history of renal cell cancer was treated with left radical nephrectomy 6 months ago. He did not receive chemotherapy or any pharmacological treatment after the operation. The patient was referred to Nuclear Medicine Department for restaging with $^{18}$F-FDG PET/CT due to recently diagnosed right adrenal mass in abdominal CT.

The scan was performed 70 min after intravenous injection of 363 MBq of $^{18}$F-FDG. PET/CT images showed a large, soft-tissue-attenuating right adrenal mass (44 HU) without any significant FDG uptake (SUVmax: 1.8) and increased FDG uptake in a mass (43 HU) at the upper lobe of right lung with SUVmax of 4.2 (Fig. 1).

Fig. 1. The PET/CT scan was performed 70 min after intravenous injection of 363 MBq (9.8 mCi) of $^{18}$F-FDG. Maximum intensity projection (A), axial PET (B, E), PET/CT fusion (C, F) and CT (D, G) at level of upper abdominal and thoracic images showed a large right adrenal mass ($60 \times 45$ mm dimensions, 44 HU) without any significant FDG uptake (SUVmax: 1.8) (open arrows) and increased FDG uptake in a mass ($20 \times 21$ mm dimensions, 43 HU) at the upper lobe of right lung (arrows) with SUVmax of 4.2. The distribution of FDG in the other sides of the body was normal.
Both lesions were biopsied and histopathologic diagnosis was renal cell carcinoma metastasis for both of them.

$^{18}$F-FDG PET/CT for adrenal gland imaging in cancer patients allows early detection and accurate localization of adrenal lesions and differentiation of metastatic nodules from benign lesions, thereby facilitating treatment planning. However, false-negative findings may be seen in adrenal metastatic lesions with hemorrhage or necrosis and small-sized (<10-mm) metastatic nodules. None of these reasons was present in our case. The size of the adrenal mass was $60 \times 45$ mm in diameters which can be easily detected by PET/CT. The attenuation value of the adrenal mass was 44 HU showing that the density of the mass was compatible with soft tissue without necrosis.

FDG is converted to FDG-6-phosphate intracellularly by hexokinase and trapped in tissue. Glucose-6-phosphatase (G6P-ase) mediated dephosphorylation of FDG slowly occurs in most tumors. A few tumors may have higher G6P-ase activity resulting in relatively low uptake, a feature that has been described in hepatocellular carcinoma.

Metastasis is the end result of a complex series of genetic alterations, epigenetic events, and host responses. Studies demonstrated that the host microenvironment has a profound influence on a number of tumor cell parameters including tumor growth, invasive behavior, response to chemotherapeutic agents, and growth factor and cytokine production. Tumor–host interactions were also shown to influence gene expression patterns in metastatic foci.\(^1\)

$^{18}$F-FDG PET/CT is an efficient non-invasive technique in the diagnosis, staging and restaging in most cancer types but is not considered the initial diagnostic imaging modality of choice in renal cell carcinoma.\(^2\) It supplies additional information about the metabolic characteristics of a lesion visualized with other anatomical imaging procedures and seems to be more promising in the detection of metastasis.\(^3\) In this case, FDG PET/CT correctly diagnosed hypermetabolic lung metastasis but missed the adrenal metastatic lesion due to low metabolic activity. The different metabolic status of these lesions may be caused by either the different cell clones of primary tumor, that can metastasize to different sites, or the different microenvironments in the metastatic region.

References