Multifocal Head and Neck Paraganglioma Evaluated with Different PET Tracers: Comparison Between Fluorine-18-Fluorodeoxyglucose and Gallium-68-Somatostatin Receptor PET/CT

Paola Castaldi · Giorgio Treglia · Vittoria Rufini

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We report the case of a 46-year-old woman with a succinate dehydrogenase subtype D (SDHD) gene mutation and multifocal head and neck paraganglioma evaluated with fluorine-18-fluorodeoxyglucose and gallium-68-somatostatin receptor positron emission tomography/computed tomography (PET/CT). Gallium-68-somatostatin receptor PET/CT correctly assessed the extent of the disease in this patient, detecting additional lesions compared with fluorine-18-fluorodeoxyglucose PET/CT and influencing the patient management.

A 46-year-old woman was referred to our centre for surveillance of a gastrointestinal stromal tumour (GIST). The patient underwent fluorine-18-fluorodeoxyglucose positron emission tomography/computed tomography (F-18-FDG-PET/CT), which demonstrated a focal area of increased radiopharmaceutical uptake corresponding to a lesion located between the right carotid vessels (*yellow arrow*; Fig. 1a). This F-18-FDG-PET/CT finding was suspicious for a paraganglioma of the neck.

The patient underwent further examinations, including biochemical and genetic tests and a somatostatin receptor PET/CT using somatostatin analogues labelled with gallium-68 (Ga-68-DOTANOC-PET/CT).

Laboratory data were suspicious for a non-functioning neuroendocrine tumour. Increased serum chromogranin A

value and normal values of plasmatic and urinary catecholamines and their metabolites were found. The patient had no symptoms of a functioning tumour.

Genetic tests demonstrated the presence of a succinate dehydrogenase subtype D (SDHD) gene mutation, which is associated with head and neck paragangliomas.

Surprisingly, Ga-68-DOTANOC-PET/CT (Fig. 1b) showed multiple bilateral areas of increased radiopharmaceutical uptake in the head and neck region, corresponding to bilateral neuroendocrine lesions and suggesting the presence of bilateral paragangliomas (*yellow arrows*) with small cervical lymph nodal metastases with short axis less than 1 cm of diameter (*red arrows*). Physiological radiopharmaceutical uptake in the pituitary is also evident (*blue arrow*).

The patient refused surgery and, based on somatostatin receptor PET/CT findings, she underwent therapy with somatostatin analogues.

Paragangliomas are rare neuroendocrine tumours arising anywhere along the paraganglial system, with a high frequency of hereditary forms or multifocal disease [1, 2]. Functional imaging with different PET tracers (including F-18-FDG to study the glucose metabolism, F-18-DOPA to study the dopaminergic metabolism and Ga-68-somatostatin analogues to study the somatostatin receptors expression) in combination with morphological imaging may be required to assess the extent of the disease in extra-adrenal paragangliomas [1]. Recent data indicate that the choice of PET tracer should be tailored according to the tumour localisation and the genetic status [1].

Recently, Timmers et al. [3], evaluating a large series of patients with paraganglioma, demonstrated that F-18-FDG-PET/CT is suitable for routine functional imaging of this tumour, particularly in patients with SDH-related tumours. F-18-FDG-PET/CT has the potential to be useful in

P. Castaldi · V. Rufini
Institute of Nuclear Medicine, Catholic University of the Sacred Heart, Rome, Italy

G. Treglia (✉)
Department of Nuclear Medicine and PET/CT Centre, Oncology
Institute of Southern Switzerland, via Ospedale, 12, 6500
Bellinzona, Switzerland
e-mail: giorgiomednuc@libero.it

Fig. 1 Radiotracer imaging results for the head and neck of the patient. **a** F-18-FDG-PET/CT; **b** Ga-68-DOTANOC-PET/CT

paraganglioma imaging, not only for detection of metastases but also as a prognostic tool identifying tumours with a high metabolic rate and high metastatic potential [2, 4].

On the other hand, recent studies demonstrated that Ga-68-somatostatin analogue PET/CT is an accurate functional imaging method in patients with neuroendocrine tumours [5], including those with head and neck paraganglioma [6]. This imaging technique non-invasively provides data on receptor expression on neuroendocrine tumour cells with direct therapeutic implications, identifying those patients who are eligible for a treatment with somatostatin analogues.

F-18-DOPA is another PET tracer which has been particularly useful in patients with head and neck paraganglioma [7]. To date, significant studies comparing F-18-DOPA and Ga-68-somatostatin receptor PET/CT in this setting are still lacking.

In our case, Ga-68-somatostatin receptor PET/CT correctly assessed the extent of the disease in a patient (carrier of an SDHD gene mutation) with multifocal head and neck paragangliomas. In fact, additional lesions were detected by Ga-68-somatostatin receptor PET/CT compared with F-18-FDG-PET/CT, influencing patient management.

However, large prospective and multicentre studies comparing different PET tracers in patients with head and neck paragangliomas carriers of different gene mutations are needed in order to establish the most useful PET tracer in this setting.

Conflicts of interest None.

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