Introduction

The role of 2-[18F]Fluoro-2-deoxyglucose-Positron Emission Tomography/Computed Tomography ([18F]FDG-PET/CT) in the management of solitary lung nodules has been extensively studied1-3. [18F]FDG uptake reflects on the cell’s glycolitic activity, which is increased in the setting of malignant tumors and during inflammation4, becoming sometimes hard to distinguish between them. [18F]FDG uptake is also increased as the tumor mass becomes larger and the blood supply is limited because hypoxia stimulates metabolic activity in cancer cells5. The case presented appears to be paradoxical as the highest uptake was documented in the smaller benign lesion, whereas the cancerous lesion was less radioactive in spite of its larger size, and its potentially higher metabolic activity.

Incidentally, the patient presented another rare condition known as elastofibroma dorsi, a benign tumor which can also be a possible source of false results in the PET exam. We provide explanations and possible solutions to these findings in order to familiarise the physician with them, and optimise patient management.

Case description

A 76 year old woman with mild dyspnea, right dorso-lumbar pain lasting 6 months and no other relevant clinical history presented with a hiperdensity in the right lung as revealed by a chest X-ray. A contrast enhanced thorax helical multidetector Computed Tomography (CT) showed a solid parenchymal lesion (27 mm in transax-
ial diameter) in the dorsal segment of the right lung upper lobe with irregular margins and tracts connecting with the pleura. A second solid lesion was localised in the basal pyramid of the right inferior lobe (38 mm in transaxial diameter) of heterogeneous characteristics, irregular borders and contacting the scissure. The CT scan also revealed the presence of node involvement in the hilar region of the right lung. The abdomino-pelvic and brain CT were anodyne.

Given the two lung lesions described, the patient was sent to the nuclear medicine department for an $^{18}$F-FDG-PET/CT scan for further characterisation. This scan revealed the presence of $[^{18}F]FDG$ uptake in the lesion of the right upper lobe with a maximal standardized uptake value corrected for body weight (SUVbw max) of 8.32 and a milder radiopharmaceutical uptake (SUVbw max 3.74) in the inferior right lobe. In the right hilar region, another area of light uptake was identified (SUVbw max 2.66). These findings were all interpreted as viable tumor tissue. Additionally, a $[^{18}F]FDG$ extensive uptake was localised in the right infrascapular muscle; the presence of elastofibroma was suggested (fig. 1).

The patient underwent a CT guided biopsy of the right inferior lobe lesion due to better percutaneous access, with the result being a well-differentiated adenocarcinoma.

The tumor was classified as stage IV, given the presence of lung lesions in two different lobes (M1), and followed 4 cycles of chemotherapy (carboplatinum and gemcitabine protocol). The follow-up CT scans (2 and 4 months after the biopsy) showed a decrease in transaxial diameter of the upper right lobe lesion (from 27 to 21 and further on to 20 mm). The more caudal lesion in the right lower lobe, did not show changes in transaxial diameter, though the anterior-posterior diameter seemed to reduce from 32 to 28 mm. Adenopathies visualised in the right hilar region remained stable.

Due to the radiological response, the patient was scheduled for a right upper lobe wedge resection of the lesion and right inferior lobectomy with radical hilar-mediastinal lymphadenectomy. Additional resection of the right infra-scapular lesion observed in the imaging was performed. The histopathologic report showed:

- Adenocarcinoma of right inferior lobe with focal infiltration of the visceral pleura.
- Fragment from the right superior lobe containing multiple small nodules (maximum axial diameter 5 mm) corresponding to chronic giant-cellular necrotizing granulomatous inflammation, positive for alcohol-acid resistant bacilli.
- All lymphadenopathies resected showed histiocitosis, anthracosis and focal giant-cellular granulomatous inflammation.
- Posterior thoracic wall formation was positive for elastofibroma.
The patient recovered successfully and was restaged postsurgically ypT2ypN0. No further adjuvant therapy was indicated, and she was referred to a specialist for specific tuberculosis treatment.

Discussion

The role of [18F]FDG-PET in characterising solitary lung nodules has been extensively studied. Increased [18F]FDG uptake has been reported in almost all tumor types with an accuracy of 96.8% and a specificity of 78%. However, [18F]FDG is not a tumor specific agent and many benign lesions have demonstrated uptake in PET studies, hence histologic confirmation is mandatory in the initial stage of malignancy. Once malignancy is confirmed FDG-PET may also allow staging of disease pursuing radical surgery in the initial stages, neoadjuvant chemotherapy and surgery in locally advanced tumors, and palliative chemotherapy in patients with IIIB-IV disease. In the presence of several radiologically suspicious lesions, tissue sampling should always be performed whenever possible. In this sense, Borrego et al study the efficacy and clinical impact of FDG-PET in the staging of non-small cell lung carcinoma in 115 patients showing that the second most frequent site for false positive findings is the lung parenchyma, after the mediastinum. Biopsy of equivocal lesions, is therefore specially relevant in this site. In our case, the presence of two parenchymal lesions was confirmed through imaging, although pathologic confirmation was only achievable in one of them. The fact that the benign tuberculous lesion of the upper right lobe had a particularly difficult biopsy access and a surprisingly high FDG uptake, lead to disease upstaging. Through this case report, we therefore want to put emphasis on the role of FDG-PET imaging in the staging of non-small cell cancer. In our case, tuberculoma showed a decrease in volume following chemotherapy treatment, whereas the tumor lesion hardly responded. Sandrini et al in a recent work, demonstrated the bactericidal effect of gemcitabine and other nucleoside analogs on S. pyogenes in a mouse model, so that a similar effect on TB infection cannot be discarded as a possible cause for our findings.

Although the end point of this case was to outline the misdiagnosis of 1 disease and the causes of the false positive (FP) finding, the concomitant appearance of hilar nodes has its own relevance. The accuracy of PET has been proved to be consistently superior to CT in identifying N1-3 disease with an overall sensitivity of 79%-84% and a specificity of 89%-91%. Even so, in mediastinal staging the presence of FP results, makes histologic confirmation necessary. In our study, hilar nodes showed increased tracer uptake in the PET/CT scan, and hence where initially assumed as tumoral. There are studies which identify the presence of hyperintense/calcified nodes as benign in more than 90% of the cases regardless of the [18F]FDG uptake. Others propose sampling of every mediastinal node seen on PET during mediastinoscopy in order to improve accuracy. Generally, increased awareness of the possibility of diverse pathological processes should be recommended, specially in TB endemic countries.

Incidentally, our patient presented with another lesion, an elastofibroma. This is a rare benign tumor of unclear pathophysiology, more prevalent in elderly women and usually localised at the tip of the scapula. It may be bilateral, and although it is usually clinically silent, it can cause swelling, snapping with arm movement, or pain, as was our patient’s case. It is mainly composed of fibrous collagenous strands, hence biopsy is frequently inconclusive due to its hypocellularity. If no symptoms appear, no treatment is required, thus differential image diagnosis is crucial. CT appearance is usually diagnostic, showing a mass with margins indistinguishable from the surrounding muscle, with internal striations or scattered areas of fat attenuation. PET images have been previously described showing light-moderate diffuse [18F]FDG uptake with a SUV around 1.8. Physicians should become familiarised with this entity in order to avoid false positive results in cancer patients.

References
