Coexistence of Physiologic and Abnormal Muscle Uptake of Fluorine-18-Fluorodeoxyglucose in a Patient with Plasma Cell Leukemia

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Fluorine-18-fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET/CT) performed for restaging in a 70-year-old male patient with history of plasma cell leukemia (PCL) showed increased symmetrical and asymmetrical fluorine-18-fluorodeoxyglucose (FDG) uptake in some muscular groups. Magnetic resonance imaging showed structural abnormalities in the area of asymmetrical muscle uptake at FDG-PET/CT. Symmetrically increased FDG uptake was considered of functional significance. The pattern of muscle uptake at FDG-PET and the presence of concomitant abnormalities at the corresponding CT scan were useful to discriminate between physiological and abnormal findings in this patient with PCL (Figs. 1, 2 and 3).

Fig. 1 A 70-year-old male patient previously treated for plasma cell leukemia (PCL), secondary to multiple myeloma, was referred to our institute because of the onset of low back pain radiating to the left leg and walking difficulties (the patient was on a wheelchair). Radiological examination showed multiple lytic lesions of the dorsal-lumbar spine. FDG-PET/CT scan was performed for restaging. FDG was injected (activity: 263 MBq) after the patient had fasted for at least 6 h. The patient was euglycemic at the time of FDG injection. Images were acquired one hour after radiopharmaceutical injection. Maximum standardized uptake values (SUV_{max}) were used to semi-quantitatively measure the FDG uptake. FDG-PET maximum intensity projection (MIP) showed multiple areas of increased radiopharmaceutical uptake corresponding to several muscle groups bilaterally (*yellow arrows*), including infraspinatus, paravertebral, external oblique, sartorius and external obturator muscle. Furthermore, an area of increased FDG uptake was observed in the left gluteus medius (*red arrow*)

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Fig. 2 Axial CT (*first column*), PET (*second column*) and PET/CT (*third column*) showed multiple areas of symmetrically increased FDG uptake corresponding to several muscle groups (*yellow arrows*), without any significant abnormalities at the corresponding CT scan. The muscles with increased FDG uptake bilaterally were the infraspinatus (*first row*; SUV_{max} : 6.8 on the left and 5.6 on the right), the

paravertebral muscles (*second row*; SUV_{max} : 8.5 on the left and 9.9 on the right), the external oblique (*third row*; SUV_{max} : 7.1 on the left and 7.9 on the right), the sartorius (*fourth row*; SUV_{max} : 4.5 on the left and 5.4 on the right) and the external obturator (*fifth row*; SUV_{max} : 2.5 on the left and 4.8 on the right). Lytic spine lesions on CT images did not show any significant FDG uptake (*white arrow*)

Fig. 3 Axial PET (*first row*), CT (*second row*) and PET/CT (*third row*) images showed also the presence of an area of asymmetrical increased FDG uptake corresponding to the left gluteus medius muscle (*red arrows*), with a SUV_{max} of 7.9. CT scan demonstrated swelling of this muscle. Axial T2-weighted magnetic resonance image (*fourth row*) showed the presence of a hyperintense area corresponding to the left gluteus medius (*red arrow*). These PET/CT and magnetic resonance imaging findings were interpreted as disease localization. On the other hand, muscle groups with symmetrical FDG uptake did not show any abnormalities at magnetic resonance imaging: these findings were considered of functional significance. PCL is a rare malignancy, defined by the presence of more than $2 \times 10^9/L$ circulating plasma cells or more than 20 % of nucleated peripheral blood cells. Survival is short, especially in PCL secondary to multiple myeloma and in older patients [1–3]. In a previous report, we have already described atypical muscle uptake of FDG in a patient with secondary PCL [4]. Conversely, in the present case, FDG-PET/CT demonstrated the coexistence of areas of physiological and abnormal muscle uptake in a patient with PCL. Symmetrically increased FDG uptake in the muscles, in absence of abnormal findings on conventional imaging, is usually considered of functional significance, as in our patient who pushed himself on a wheelchair because of walking difficulties. Increased symmetrical FDG uptake in muscles can be usually attributed to voluntary or involuntary muscle activity, hyperinsulinemia and compensatory hypertonus after surgical interventions [5–9]. On the other hand, areas of asymmetrically increased FDG uptake in the muscles could be interpreted as abnormal findings at PET imaging, particularly if concomitant alterations on conventional imaging are detected, as in our patient. FDG-PET/CT can be useful in the staging and restaging of PCL, due to its ability to recognize recurrences in atypical sites, like the muscles. However, the pattern of muscle uptake at FDG-PET (symmetrical or asymmetrical), and the presence of concomitant abnormalities at the corresponding CT scan, could be useful to discriminate between physiological and abnormal findings in patients with PCL

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References

- Kyle RA, Maldonado JE, Bayrd ED. Plasma cell leukemia: report on 17 cases. *Arch Intern Med.* 1974;133:813–8.
- Lorsbach RB, Hsi ED, Dogan A, et al. Plasma cell myeloma and related neoplasms. *Am J Clin Pathol.* 2011;136:168–82.
- Tiedemann RE, Gonzalez-Paz N, Kyle RA, et al. Genetic aberrations and survival in plasma cell leukemia. *Leukemia.* 2008;22:1044–52.
- Cocciolillo F, Treglia G, Villani MF, et al. Atypical presentation of plasma cell leukemia secondary to multiple myeloma detected by F-18 FDG PET/CT. *Clin Nucl Med.* 2011;36:e220–3.
- Yokoyama I, Inoue Y, Moritan T, et al. Simple quantification of skeletal muscle glucose utilization by static 18F-FDG PET. *J Nucl Med.* 2003;44:1592–8.
- Kelley DE, Williams KV, Price JC. Insulin regulation of glucose transport and phosphorylation in skeletal muscle assessed by PET. *Am J Physiol Endocrinol Metab.* 1999;277:E361–9.
- Tashiro M, Fujimoto T, Itoh M, et al. 18F-FDG PET imaging of muscle activity in runners. *J Nucl Med.* 1999;40:70–6.
- Aydin A, Hickeson M, Yu JQ, et al. Demonstration of excessive metabolic activity of thoracic and abdominal muscles on FDG-PET in patients with chronic obstructive pulmonary disease. *Clin Nucl Med.* 2005;30:159–64.
- Jackson RS, Schlarman TC, Hubble WL, et al. Prevalence and patterns of physiologic muscle uptake detected with whole-body 18F-FDG PET. *J Nucl Med Technol.* 2006;34:29–33.