Non-corrected images guide correct interpretation of FDG PET/CT: Artifactual FDG uptake in vertebra due to bone cement

Sir,

Presence of high density material in patient's body can result in artifacts in positron emission tomography/computed tomography (PET/CT) images because of attenuation correction.[1] In such cases, non-attenuation corrected (NAC) images can better characterize the PET/CT findings. We present fluoro-2-deoxy-d-glucose (FDG) PET/CT findings in an elderly Indian female, which showed artifactual increased FDG uptake in a dorsal vertebra due to presence of bone cement in it.

A 60-year-old Indian female was diagnosed to have fracture of tenth dorsal (D-10) vertebra after a trivial fall. She was treated for the same by vertebroplasty. The biopsy of marrow obtained at the time of surgery showed 5-6% plasma cells. Her laboratory examination showed presence of Bence-Jones protein in urine, 'M' band in serum electrophoresis. Bone densitometry studies showed severe osteoporosis. With this history, she was suspected to have multiple myeloma/plasmacytoma. The differential diagnosis considered, was osteoporotic fracture in a case of monoclonal gammopathy of undetermined significance (MGUS). Two months after surgery, she underwent a whole body FDG PET/CT scan for identifying sites of active disease and identifying optimum site for biopsy. The PET/CT showed intense FDG uptake in D10 vertebra [Figure 1a-c; arrow], suggesting metabolically active disease. Corresponding CT images [Figure 1d] showed presence of bone cement used for strengthening the vertebra. The density of bone cement was in the range of 2,600-3,000 Hounsfield units (HU). Rest of the body showed physiological distribution of tracer with no abnormal FDG uptake or CT demonstrable lesion. However, a careful review of PET/CT images along with NAC images showed that the FDG uptake seen in D10 vertebra was artifactual. The NAC image [Figure 1e] did not reveal abnormal FDG uptake in the D10 vertebra. The scan was reported to have no significant abnormality. The patient is currently receiving treatment for osteoporosis and being followed up for MGUS.

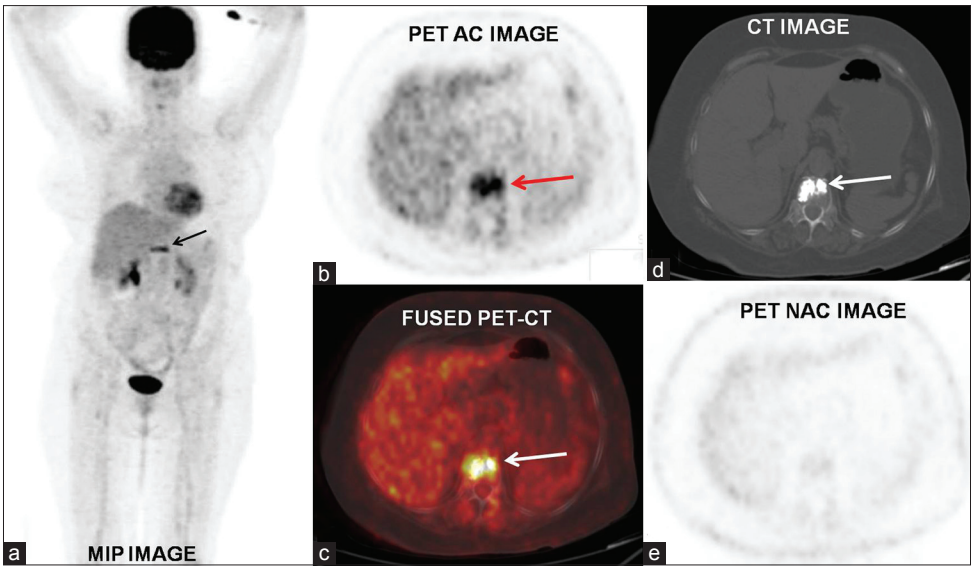

Figure 1: [18F] fluoro-2-deoxy-d-glucose positron emission tomography/computed tomography (F-18 FDG PET/CT) scan. (a) The maximum intensity projection (MIP) image. (b) Attenuation corrected PET only image and (c) Fused PET-CT images- reveal increased tracer uptake in D10 vertebra. (d) Corresponding CT images showed presence of bone cement used for strengthening the vertebra. (e) The NAC image did not reveal abnormal FDG uptake in the D10 vertebra

CT-based attenuation correction in PET/CT imaging is more rapid than the traditional transmission attenuation correction, thus reducing the overall whole-body PET scanning time by 30-40% and allowing higher patient through put. However, the use of the CT scan for attenuation correction has the drawback of producing artifacts on the resulting PET images.[1] High density material such as metallic joint prosthesis, dental implants, and intravenous CT contrast are known to cause artifactual increased FDG uptake.[2,3] These high density materials result in high CT HU, eventually resulting in correspondingly high PET attenuation coefficients, which lead to an overestimation of the PET activity in that region and thereby to a false-positive PET finding. NAC images are reported to be useful for identification of this artifact.[1] In vertebroplasty, a cement is injected through a needle into porous bone, with the porosity commonly caused by osteoporosis or malignancy.[4,5] This cement reinforces the bone to reduce further fracture. This cement has a density of around 2,000-3,000 HU (much denser than normal bone). PET/CT uses the transmission scan from the CT as a density map for attenuation correction of the measured activity.[6] In this case, the attenuation correction algorithm added back too many counts to compensate for attenuation by the extremely dense cement. Similar finding was reported by Kuo and Cheng in their case report.[7] Our case suggests, careful review of NAC images is essential, when increased FDG uptake is noted at the sites of high density material. Knowledge of causes of artifactual FDG uptake is essential to prevent misdiagnosis of metabolically active disease.

Prathamesh Joshi, Vikram Lele[1], Hina Shah[1]

Departments of Nuclear Medicine and Positron Emission Tomography-Computed Tomography, Bombay Hospital and Research Centre, [1]Jaslok Hospital and Research Centre, Mumbai, India

Address for correspondence:
Dr. Prathamesh Joshi,
Department of Nuclear Medicine and Positron Emission Tomography-Computed Tomography, Bombay Hospital and Medical Research Centre, Mumbai, India
E-mail: drprathamj@gmail.com

REFERENCES

1. Sureshbabu W, Mawlawi O. PET/CT imaging artifacts. J Nucl Med Technol 2005;33:156-61.
2. Goerres GW, Ziegler SI, Burger C, Berthold T, von Schulthess GK, Buck A. Artifacts at PET and PET/CT caused by metallic hip prosthetic material. Radiology 2003;226:577-84.
3. Antoch G, Freudenberg LS, Egelhof T, Stattaus J, Jentzen W, Debatin JF, *et al.* Focal tracer uptake: A potential artifact in contrast-enhanced dual-modality PET/CT scans. J Nucl Med 2002;43:1339-42.
4. Diamond TH, Hartwell T, Clarke W, Manoharan A. Percutaneous vertebroplasty for acute vertebral body fracture and deformity in multiple myeloma: A short report. Br J Haematol 2004;124:485-7.
5. Shimony JS, Gilula LA, Zeller AJ, Brown DB. Percutaneous vertebroplasty for malignant compression fractures with epidural involvement. Radiology 2004;232:846-53.
6. Kinahan PE, Hasegawa BH, Beyer T. X-ray-based attenuation correction for positron emission tomography/computed tomography scanners. Semin Nucl Med 2003;33:166-79.
7. Kuo PH, Cheng DW. Artifactual spinal metastases imaged by PET/CT: A case report. J Nucl Med Technol 2005;33:230-1.

Access this article online

Quick Response Code:

Website: www.ijnm.in

DOI: 10.4103/0972-3919.125783