Technical Note

Correction of Positron Emission Tomography Maximum Intensity Projection Image Artifact Using Retro Reconstruction Method

Abstract

Artifacts in positron emission tomography (PET)/computed tomography imaging can result from a number of factors. Presence of imaging artifacts affects interpretation and can sometimes render the image uninterpretable. Correction of artifacts can be attempted by reprocessing of data. In the present study, one PET maximum intensity projection image artifact was corrected by employing the method of retro-reconstruction.

Keywords: *Artifact, artifact correction, positron emission tomography/computed tomography, reconstruction*

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Introduction

Artifacts in patient imaging denotes any abnormality in image which is not a true representation of the physiological or anatomical information of the patient.[1] Positron emission tomography/computed tomography (PET/CT) image artifacts can be related to any of the following factors: the patient, radiotracer, or instrumentation.[2] Various artifacts can also be seen due to correction of the PET data using CT.[3,4] These artifacts can result in incorrect quantification, misinterpretation, or incomplete scan information.[5-7] Some of these artifacts can be corrected post imaging. However, few of the artifacts which cannot be corrected, render the image inappropriate for deriving the desired information. This may require subjecting the patient to re-imaging and hence, increased patient distress and radiation dose. Many image artifacts in PET/CT imaging have been documented in literature, along with the method of correction for few.[8,9] Artifacts can be minimized by using standard procedures during image acquisition, but it is not always possible, for example artifacts arising due to extravasation of administered radioactivity. We share our experience of a PET maximum intensity projection (MIP) image artifact which can be seen commonly in PET/CT imaging due to extravasation of radiotracer and it is correction.

Case Reports

Case 1

Whole-body PET/CT images of a patient with pyrexia of unknown origin were acquired 45 min post intravenous injection of 6.7 mCi (248 MBq) of ^{18}F-fluorodeoxyglucose (FDG) with hands by side of the body. On review of the reconstructed images, three-dimensional (3D) MIP image of the patient was found to be pixelated [Figure 1a], likely due to partial extravasation of tracer at injection site in the right hand. Presence of high tracer activity in a single-bed position due to extravasation of injected radiotracer, contamination, or due to the presence of urinary bladder activity in patients who are not able to void, can result in lesser counts in rest of the image and a pixelated 3D MIP image. The quality of transaxial PET images was not affected [Figure 1b-d, 1f-h], but it is important to correct the MIP image as MIP gives the overall review of the tracer uptake in the body and helps to identify abnormal areas of tracer uptake at a glance. In an attempt to correct this artifact, retro-reconstruction of PET data was attempted after excluding the raw data of last bed position with the extravasated activity and only seven out of eight bed positions were reconstructed. After reconstruction, corrected MIP image was obtained with no pixilation, as shown in Figure 1e.

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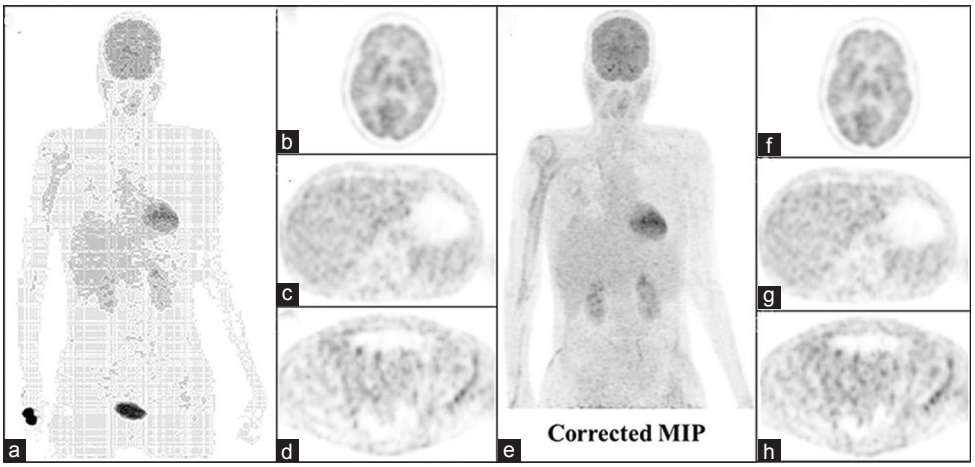

Figure 1: A 40-year-old female with pyrexia of unknown origin underwent ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography for localization of infective foci. The maximum intensity projection image (a) shows pixelation rendering it due to extravasation of radiotracer in the right hand region, rendering it uninterpretable. Maximum intensity projection image (e) obtained post correction after reducing axial field of view was free of artifact. The transaxial image quality at the level of brain, abdomen, and pelvis was not affected before (b-d) and after correction (f-h) of positron emission tomography data

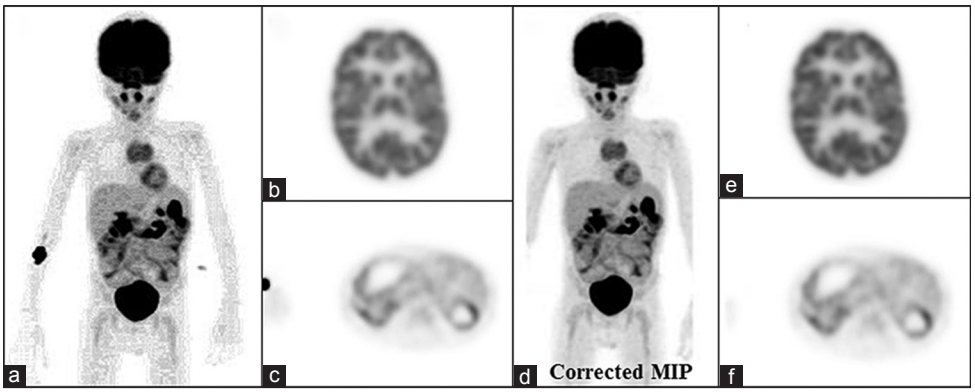

Figure 2: A 5-year-old male with Langerhans cell histiocytosis underwent ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography for evaluation of disease activity and extent. Positron emission tomography maximum intensity projection image (a) shows pixilation due to extravasation of radiotracer in the right elbow region. Maximum intensity projection image (d) obtained post correction by reducing radial field of view shows resolution of the artifact. The transaxial positron emission tomography image quality at the level of brain and abdomen was not affected before (b and c) and after correction (e and f) of positron emission tomography data

Case 2

In another patient with a referral diagnosis of Langerhans cell histiocytosis, head-to-toe PET/CT images were acquired 65 min post administration of 4.1 mCi (151 MBq) of ^{18}F-FDG with arms by the side of the body. Reconstruction of the images showed a pixelated MIP due to extravasation of activity near the elbow joint [Figure 2a]. In this case, the frame containing extravasation site was not at the periphery of the axial field of view. Hence, instead of doing retro-reconstruction by reducing the axial field of view, the display field of view (DFOV), i.e., the field of view in radial direction, was reduced from the standard 70 cm to just exclude the extravasation site without truncating the patient's body contour. Retro-reconstruction with a DFOV of 30 cm resulted in corrected MIP image, with no pixelation [Figure 2b]. The transaxial PET image quality before and after correction of MIP was not affected [Figure 2c-f].

Conclusion

The pixelation artifact in PET MIP images resulting from extravasation of radiotracer can be corrected by retro-reconstruction after reducing either the axial field of view or the radial DFOV.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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