Respiratory motion resulting in a pseudo-ischemia pattern on stress PET-CT imaging

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A 68-year-old male presented with chest pain, and a history of percutaneous coronary intervention to the right coronary artery. He had residual 80% stenosis in the mid left anterior descending artery (LAD). A dipyridamole rubidium-82 positron emission tomography (PET)–computed tomography (CT) myocardial perfusion imaging (MPI) study was performed to assess for ischemia in the LAD territory. Cardiac-gated stress images were reconstructed from the list-mode data using routine ECG-triggers. A separate respiratory-gated stress series was reconstructed using triggers that are routinely acquired using the RPM^{TM} motion tracking system. Simultaneous dual-gated images were not reconstructed, nor needed to assess the respiratory motion as described herein.

Stress perfusion showed reversible defects in the anterior wall and the opposing inferior wall, with substantial image blurring (Figure 1, top rows). Alignment of the static (ungated) stress PET–CT attenuation correction images appeared normal. There was significant breathing motion seen on the respiratory-gated stress PET images (Online Video 1) contributing to the ungated perfusion defects as a result of mis-alignment with the CT attenuation scan (Online Video 2). The stress study was interpreted using a single end-expiration respiratory phase of the PET scan (Figure 1, middle rows) that was best aligned with the CT attenuation scan, and demonstrated no significant perfusion defect compared to rest (Figure 1, bottom rows). Review of the cine-dynamic image frames did not show any obvious patient body motion during the course of the stress PET scan (Online Video 3).

This case exemplifies blurring artifact, as a result of extreme respiratory motion during a PET–CT MPI study resulting in a pseudo-ischemia pattern. This occurred due to motion blurring of the PET emission images and mis-registration with the CT attenuation scan, due to the differences in temporal resolution and breathing phase.[1] A similar opposing-wall-defect pattern can occur during SPECT imaging, but is not widely recognized with PET.[2] The incorrect alignment of CT tissue attenuation may result in over-correction or under-correction of the attenuation corrected PET data, resulting in a false-negative or a false-positive study. List-mode PET acquisition enables retrospective reconstruction of respiratory-gated cine images for visualization of breathing motion, and the ability to interpret the scan using a single co-registered respiratory frame.[3]

The reader should be cognizant of the presence of potential motion artifact in the setting of opposing-wall perfusion defects with PET imaging. This can lead to misinterpretation of the MPI study, and impact upon patient management. The fusion display of the PET and CT images can be used to select the single best respiratory phase-aligned PET image, which may reduce the attenuation correction bias and blurring effects of motion. This approach is recommended when significant respiratory motion is suspected or has occurred at peak stress.

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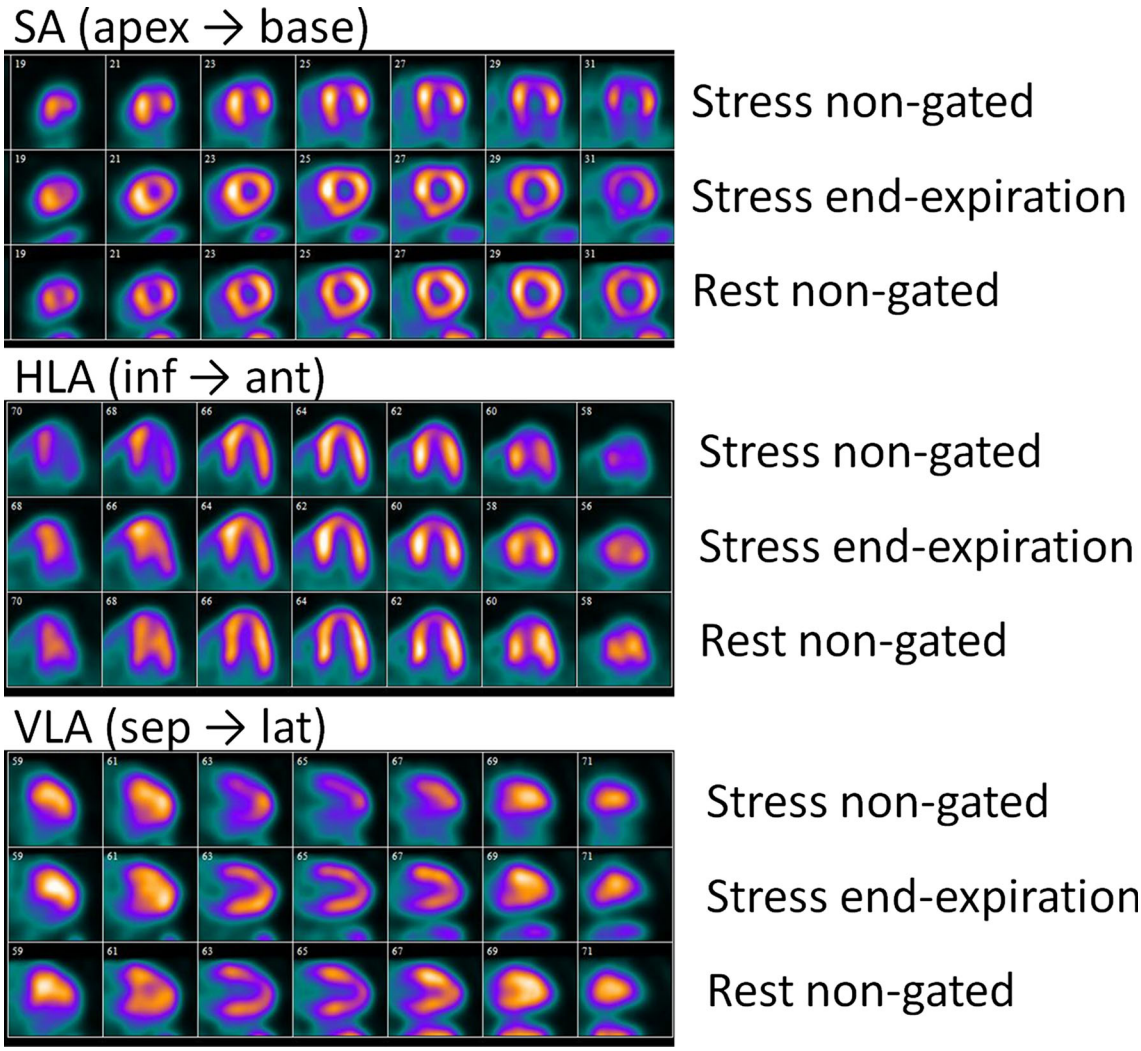

Figure 1. Rb-82 stress PET perfusion images shown in short axis (SA), horizontal long axis (HLA) and vertical long axis (VLA) views. Original non-gated images (*top rows*) demonstrate opposing wall defects (anterior and inferior) due to severe respiratory motion. These defects resolve when viewed at end-expiration (*middle rows*) using the single respiratory phase PET data with matched CT attenuation correction, and the images appear similar to those at rest (*bottom rows*) interpreted as normal.

Disclosure

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