Rescued diagnostic quality by motion correction of dynamic cardiac positron emission tomography (PET) perfusion images

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Received Dec 22, 2017; accepted Dec 26, 2017
doi:10.1007/s12350-018-1185-z

Cardiac positron emission tomography (PET) imaging is widely utilized to measure myocardial blood flow and perfusion. Patient motion is a well-recognized cause of artifacts and techniques to correct for this have been developed, primarily for single photon imaging.[1–3] Herein, we describe a case where gross patient motion during stress imaging resulted in non-diagnostic static images summed between 2 and 7 minutes. Respiratory gated images did not improve image quality (not shown). However, manual adjustment of dynamic images to correct for gross patient motion yielded diagnostic quality images and allowed detection of a proximal LAD stenosis.

A 63-year-old man, with a medical history of tuberculous meningitis, normal pressure hydrocephalus status post ventriculoperitoneal shunt, and mild cognitive impairment, presented with exertional substernal chest pain. Normal plasma cardiac troponin ruled out acute myocardial infarction. Due to new T-wave inversions on electrocardiography, additional risk stratification was sought. The patient is obese and unable to exercise. Consequently, he underwent rest and regadenoson stress cardiac PET/CT imaging using rubidium-82 as the perfusion tracer. Gross patient motion artifact rendered the study non-diagnostic by standard static reconstructions (Figure 1A). However, by manually adjusting the dynamic images acquired during this period (2 to 7 minutes) for patient motion, we resolved a completely reversible defect in the territory of proximal left anterior descending (LAD) coronary artery (Figure 1B). The patient underwent coronary angiography which confirmed proximal LAD disease and was percutaneously revascularized (Figure 2). This case highlights the utility of motion correction of the dynamic image series. The motion artifact in this case was a nearly 16 mm gross patient shift early during

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J Nucl Cardiol 2019;26:330–2.
1071-3581/$34.00

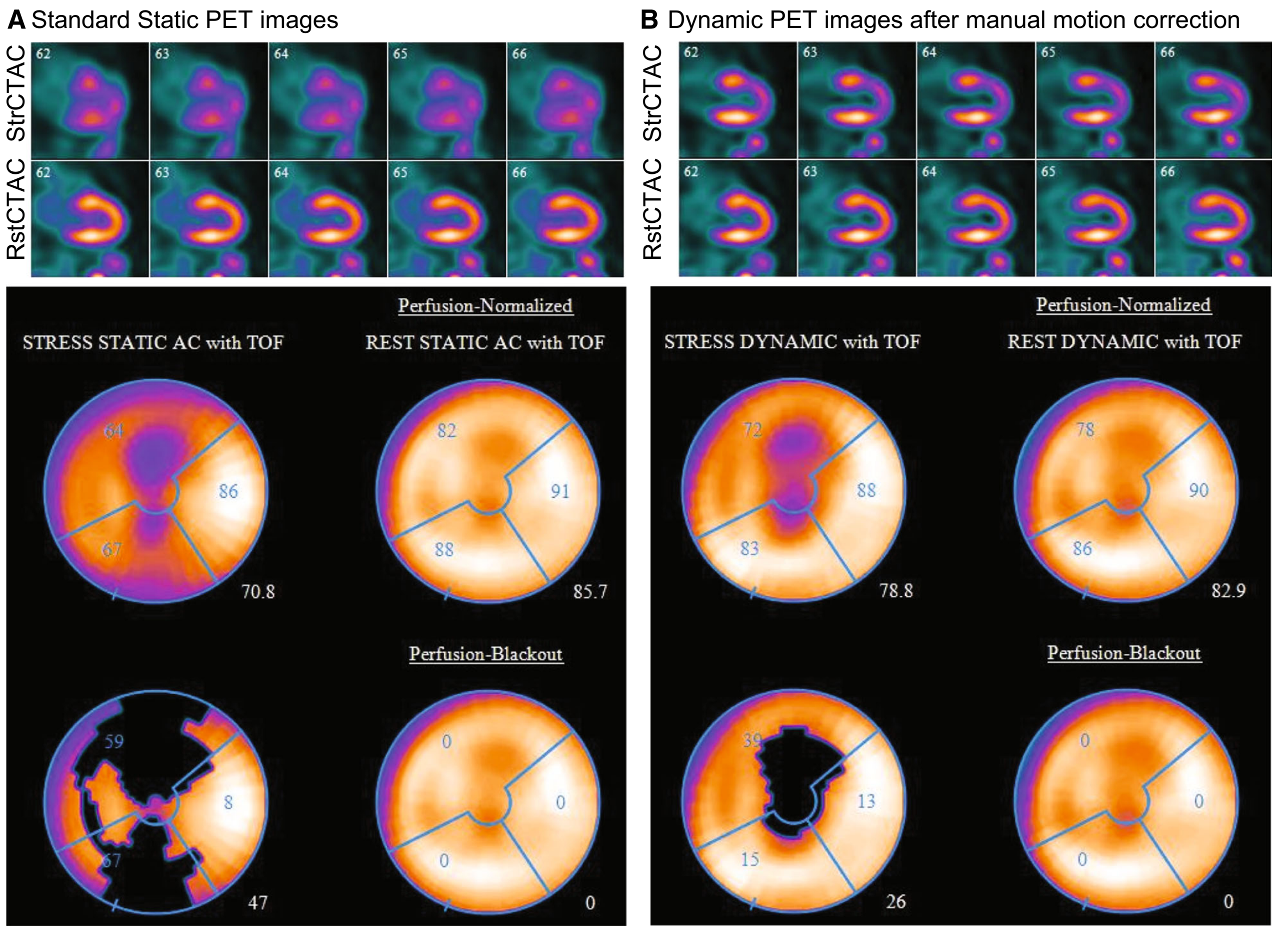

Figure 1. Reversible anterior ischemia uncovered by review of motion-corrected dynamic images **A** Static attenuated corrected images with time of flight. These images are significant motion artifact and large 180 degree perfusion defects suggestive of craniocaudal patient motion artifact. **B** Motion-corrected dynamic images resolve this artifact, revealing a completely reversible, extensive sized, mild-to-moderate severity, anterior, apical, anteroseptal, and septal perfusion defect consistent with LAD ischemia.

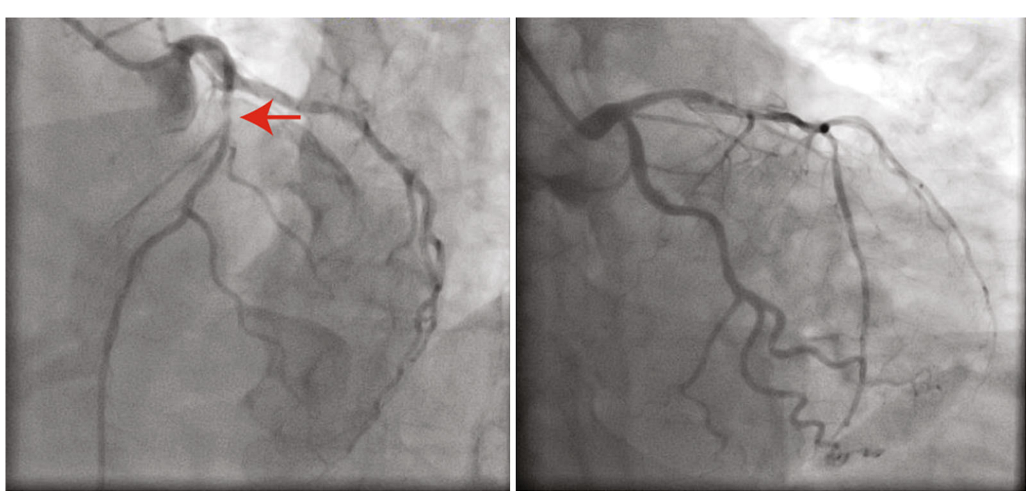

Figure 2. Coronary angiogram confirms 80% stenosis in proximal LAD (red arrow).

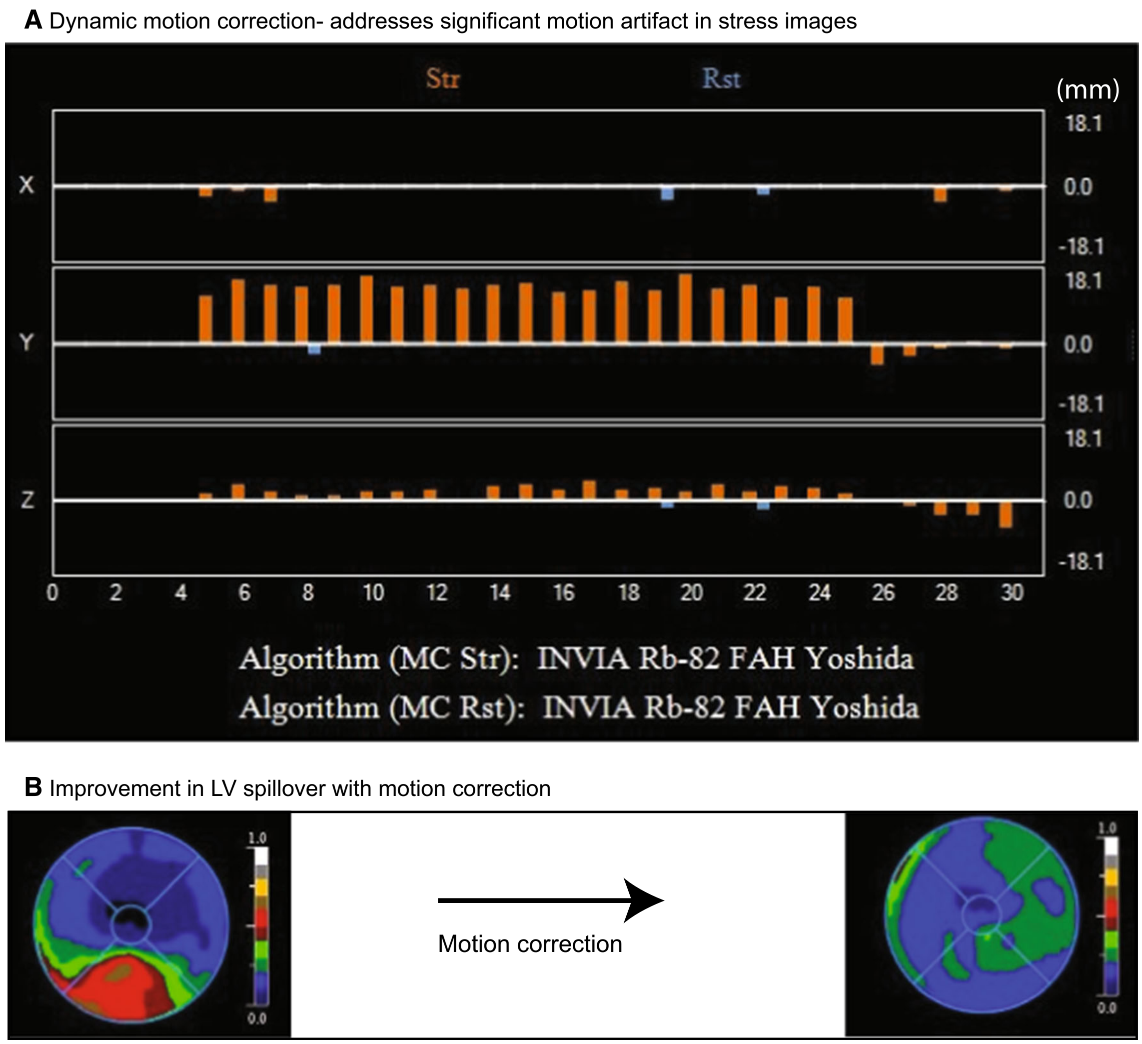

Figure 3. Dynamic motion correction. **A** Review of manual motion correction performed reveals that the patient grossly moved early in stress imaging (orange) approximately 16 mm in cranial direction (positive Y) direction. Only minimal motion occurred during rest (blue). **B** Bloodpool spillover markedly reduced with motion correction, particularly in the inferior wall. There was a change in stress myocardial blood flow from 0.6, 0.3, 1.2, and 1.6 to 2.1, 2.3, 2.4, and 2.1 mL/g/min for global, LAD, left circumflex, and right coronary arteries, respectively.

stress imaging followed by reversion to the starting position in the last phases of image acquisition (Figure 3). Motion correction also resulted in a marked reduction in blood pool spillover in the inferior wall.

Disclosure

Author EPF owns equity in INVIA Medical Imaging Solutions. Author VLM has research grants from INVIA Medical Imaging Solutions and Siemens Medical Imaging. Author VLM also has financial interests with General Electric, Cardinal Health, and Ionetix.

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