The impact of patient-to-detector distance on LV volumes and TID index on SPECT myocardial perfusion imaging: Emphasis on consistent patient-detector positioning in stress and rest phases

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INTRODUCTION

Correct interpretation of SPECT myocardial perfusion imaging (MPI) depends largely on comparability of stress and rest images from technical points of view. Here, we present two cases with inconsistent axial position of patient on the scanning table relative to detector in stress and rest phases. Images were acquired in one case with the orbit mode of auto-body contouring (ABC) and in the other case with fixed-radius non-circular orbit.

CASE HISTORY

Patient A was an 85-year-old male referred to our laboratory for an MPI for evaluation of occasional chest pain. A same-day stress-rest Dipyridamole SPECT MPI was performed. Image acquisition parameters were set as routine, including orbit mode of ABC. Because of markedly increased TID (i.e., 1.62), the rest image was repeated. As we thought this might be resulted from the greater distance between the patient's chest and detector surface set by ABC at rest compared to stress phase, we intended to position the patient as similar as possible to that in stress phase relative to the detector. Thereby, an approximately equal patient-to-detector distance in both phases was obtained and thus a TID of 1.28 was calculated. (Figure 1).

In order to assess solely the effect of different LV location in the FOV on LV volumes, we repeated imaging twice in another patient (i.e., patient B) after completion of the scan with routine protocol. This time, we used a fixed-radius non-circular orbit instead of ABC to achieve a fixed patient-to-detector distance but different axial position of patient on the scanning table relative to detector. (Figure 2).

DISCUSSION

To achieve comparable stress and rest images, it is recommended to set optimally image acquisition and processing parameters. There might be some other factors such as patient-to-detector distance and location of LV in the FOV that could have potential impacts on the results. These factors may be easily overlooked during imaging and can potentially render stress and rest images not exactly comparable.

ABC is a useful feature in newer SPECT systems to avoid collision with the patient being imaged and to maximize image resolution vs. traditional fixed-radius non-circular orbit. With this option, minimum distance specified by the user is held by the detector from the body surface throughout the scanning time, which improves spatial resolution of the image.[1,2] When the detector is not positioned optimally on the chest and/or more importantly in patients with shorter stature, the mentioned distance is determined by the detector edge from patient's chin or raised arms over the head. Therefore, an almost large distance from the chest will be obtained as in patient A. In this way, less spatial

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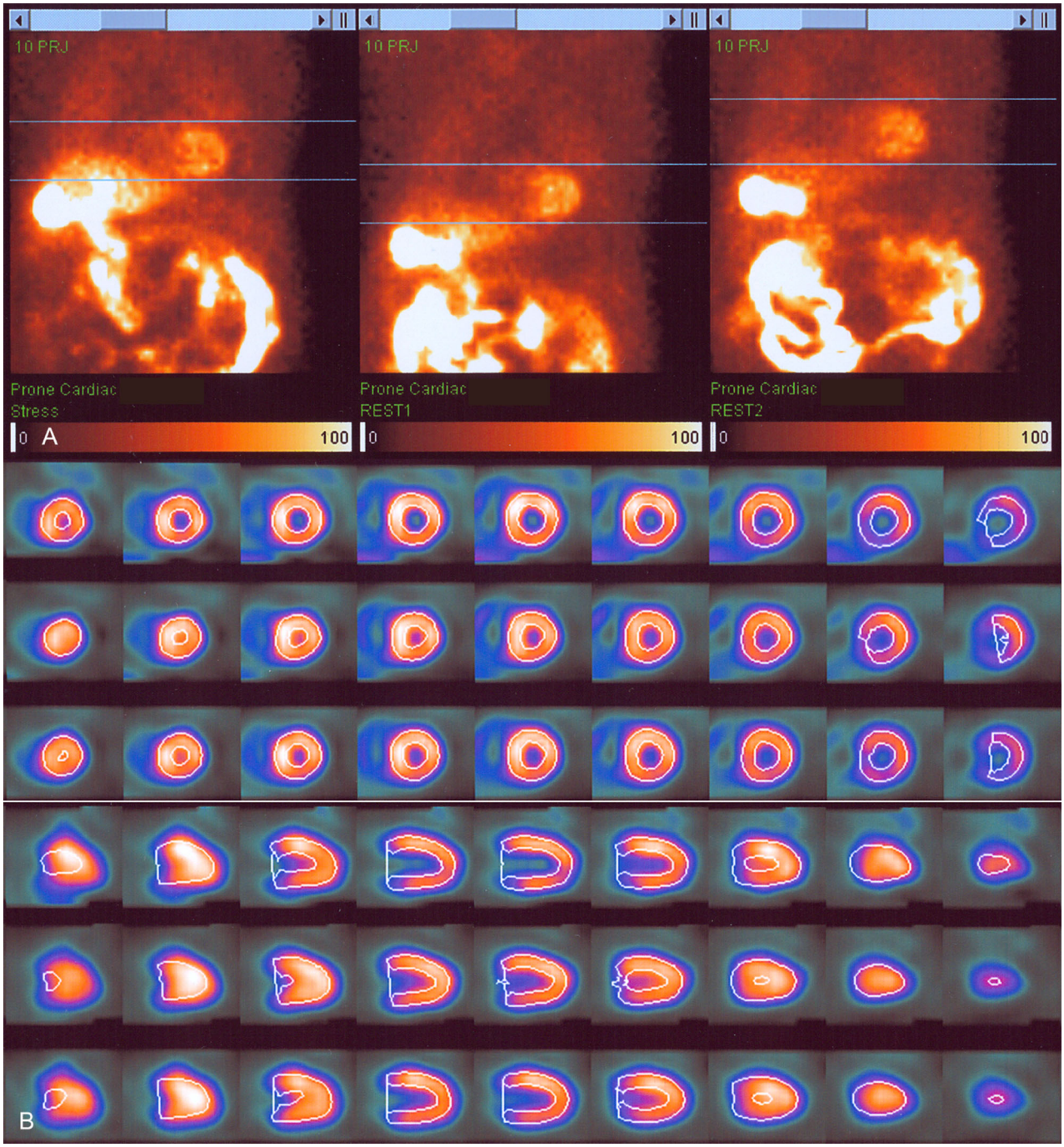

Figure 1. **A** anterior projections of SPECT MPI of stress (left), rest (middle), and repeated rest (right) phases and **B** tomographic slices of short axis (upper panel) and vertical long axis (lower panel) with contours drawn to display LV cavity with more clarity. In each panel, each row corresponds to its image set in (**A**). As can be seen, the location of the LV in the field-of-view (FOV) in rest image is different from that in stress or in other words, the detector is positioned more cephalad on the patient. Thus, the LV is located at the center of the FOV. Here, a mean LV volume of 22 mL at rest vs 36 mL at stress, and therefore, a TID of 1.62 was calculated. The rest image was repeated after moving the scanning table out of the gantry in order to position the detector more caudal on the patient. Therefore, the location of the LV in the FOV is more consistent with that in stress. Here, a mean volume of 28 mL and a TID of 1.28 were obtained.

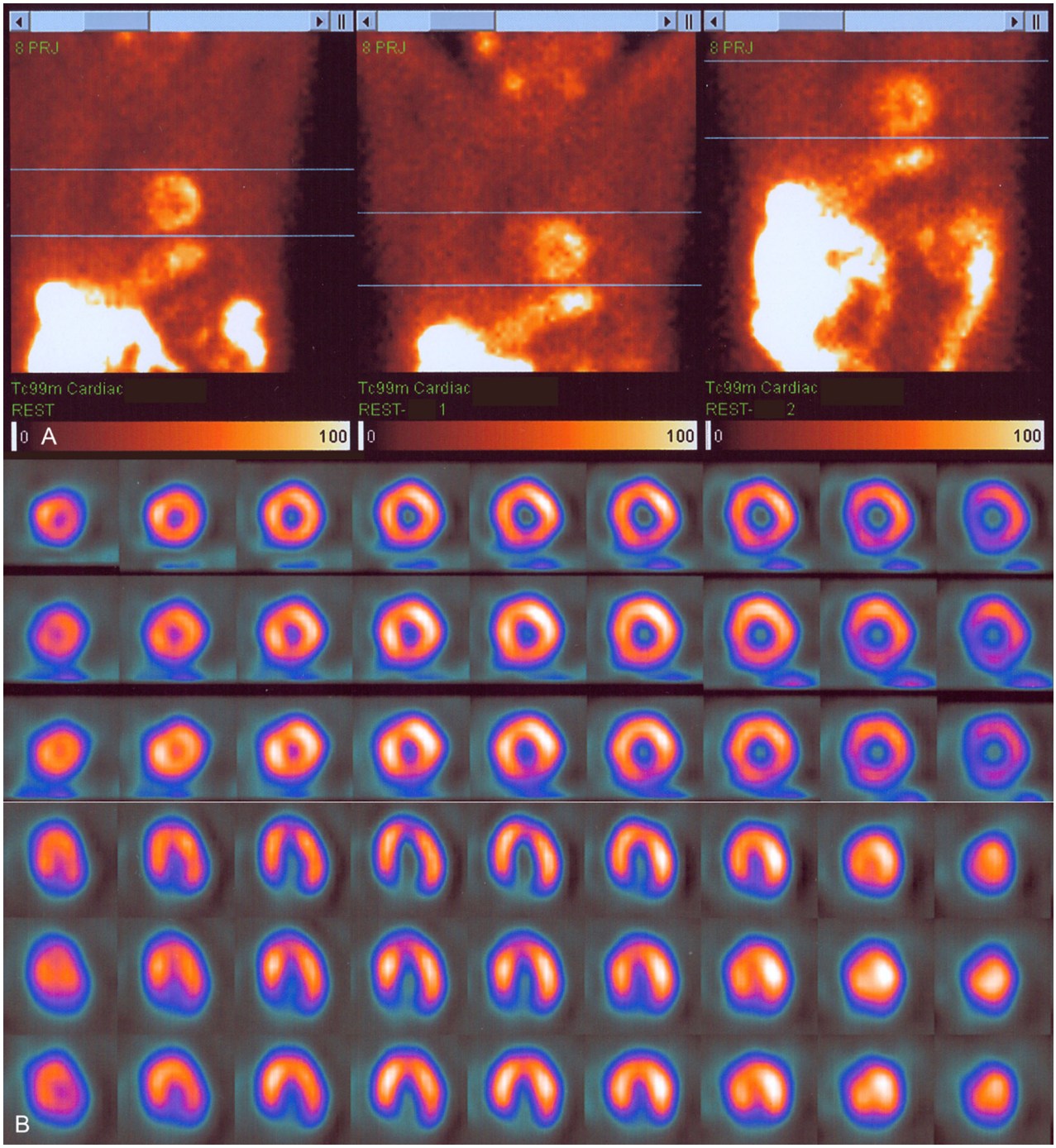

Figure 2. **A** anterior projections of SPECT MPI of rest (left), repeat of rest scan with fixed-radius non-circular orbit after moving the detector more cephalad (middle) and more caudal (right) on the patient and **B** tomographic SPECT slices of short axis (upper panel) and horizontal long axis (lower panel) of a 79-year-old male attended for cardiac evaluation for repeated episodes of chest discomfort. In each panel, each row corresponds to its image set in (**A**). The stress image is not shown here. As can be seen, the location of the LV in the FOV in rest image is different from that in both repeated ones. Here, mean LV volumes of 48, 43, and 41 mL were obtained. Although the measured volumes in scans with non-circular orbit and same radius of rotation are approximately equal, they are significantly different from the volume measured in rest scan with ABC orbit. Additionally, the slices of the scans acquired with non-circular orbit seem hazier than the slices of the scan acquired with ABC orbit. All images are filtered with the cut-off of 0.45. This can be attributed to more spatial resolution of the first scan as a result of less patient-to-detector distance with ABC orbit.

resolution leads to lower LV volumes and thus changes in TID. Therefore, this error in measurement of TID can be misleading. When the distance is held fixed by using a non-circular orbit, different locations of LV in the FOV do not solely exert a significant effect on LV volumes as demonstrated in patient B. Unfortunately, the distance cannot be inferred from cinematic images and thus the technologist should ensure proper patient-detector positioning during imaging.

In order to achieve diagnostic-quality images, every technical factor that might affect the result should be taken into account. As discussed above, patient-to-detector distance during acquisition and axial position of the patient on the scanning table relative to detector when using ABC may be also important and should be set in a way to achieve higher consistency between stress and rest studies. Otherwise, TID should be interpreted cautiously.

Disclosure

No conflict of interests is declared.

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