

SPECT/CT overcomes breast-attenuation artifact for improved specificity in 4-minute MPI study

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Data courtesy of Dr. Gary Marano, West Virginia University Medicine, Morgantown, WV, USA

History

A 69-year-old, obese female with a history of diabetes presented with atypical chest pain and shortness of breath upon exertion. The patient underwent a stress and rest myocardial perfusion SPECT/CT scintigraphy. The exam was performed on a Symbia Intevo™ system to determine presence of myocardial ischemia. The scanner was equipped with IQ•SPECT technology, which incorporates magnifying collimators, cardiac-centric acquisition, and advanced reconstruction to either reduce dose or acquisition time, without sacrificing image quality. IQ•SPECT was used to reduce scan time for this patient.

Findings

Since the patient was likely unable to achieve an adequate heart rate with exercise, pharmacological stress with dipyridamole was performed. One hour following an intravenous injection of ^{99m}Tc Myoview (24.5 mCi [906 MBq]), an initial low-dose CT topogram was performed to establish optimal positioning for cardiac imaging. Figure 1 demonstrates patient body habitus, which shows the potential risk of breast attenuation. After the cardiac region was defined, a 4-minute IQ•SPECT acquisition was conducted. A low-dose CT was performed for attenuation correction (AC). The rest study was performed on the same day following an injection of ^{99m}Tc Myoview (9.0 mCi [333 MBq]) with similar acquisition protocols using IQ•SPECT. Uncorrected stress IQ•SPECT images show a mild decrease in tracer uptake in

the anterior and anteroseptal wall (Figure 2). This defect demonstrated significant improvement on the CT-attenuation correction (CTAC) images, suggesting that the apparent defect was secondary to breast attenuation. The remainder of the left ventricle (LV) shows normal distribution of the radiotracer and the LV cavity size appears normal (MPI). Fused CT and SPECT images in axial and coronal plane show the accuracy of image registration, which is critical when using CTAC to avoid artifactual defects (Figure 3).

Comments

Ischemic heart disease (IHD) is the leading cause of death in women globally according to the World Health Organization (WHO).¹ A consensus statement from the American Society of Nuclear Cardiology (ASNC) Myocardial perfusion imaging (MPI) in women for the evaluation of stable ischemic heart disease² states, "It is well appreciated that diagnostic accuracy in women is adversely affected by gender-specific factors such as breast attenuation, small left ventricular chamber size, and a high prevalence of single-vessel coronary artery disease."

Although MPI with SPECT is an accurate and reliable diagnostic study, artifacts must be detected and corrected to minimize the rate of false-positive results. Since the location of the attenuation artifact depends on the size, shape, and position of the soft tissues near the LV, the CT attenuation map of the surrounding structures can be useful for each patient. Diaphragmatic attenuation of the LV is quite

common, resulting in an artifactual perfusion defect in the inferior wall. CTAC compensates for this and other attenuation effects, such as the anteroseptal defect due to breast attenuation in the above patient. Even in clinical patients with a low likelihood of coronary artery disease (CAD), when proper AC is applied, the images can improve the accuracy of the study and hence the interpreter’s confidence of the presence or absence of a true perfusion defect, such as inferior wall artifact compared to the anterior wall.³ More accurate diagnostic results translate into more appropriate treatments and may decrease the number of unnecessary invasive diagnostic procedures to be performed.

SPECT/CT shows characteristic distribution in the myocardium in the inferolateral and apical regions and has a unique collimator design that enables enlargement of the cardiac region without truncation. 4-minute MPI with IQ•SPECT produces image quality comparable to conventional 15-20 minute scans using low-energy high-

resolution (LEHR) collimators. Additionally, it collects 4 times as many counts from the heart during a myocardial perfusion SPECT study while maintaining the same resolution as a low-energy, high-resolution collimator. The additional counts can be used to reduce the acquisition time and also improve image quality with less patient motion with shorter acquisition time.

Conclusion

Attenuation from breast and other soft tissue often produces artifactual perfusion defects. Improved specificity gained from CTAC overcomes this challenge, thus allowing for more accurate myocardial imaging. The addition of IQ•SPECT allows for ultrafast cardiac acquisition while maintaining high image quality. Symbia Intevo combines fast cardiac acquisition using IQ•SPECT with CTAC for improved specificity compared to conventional SPECT/CT and SPECT-only examinations. ●

References

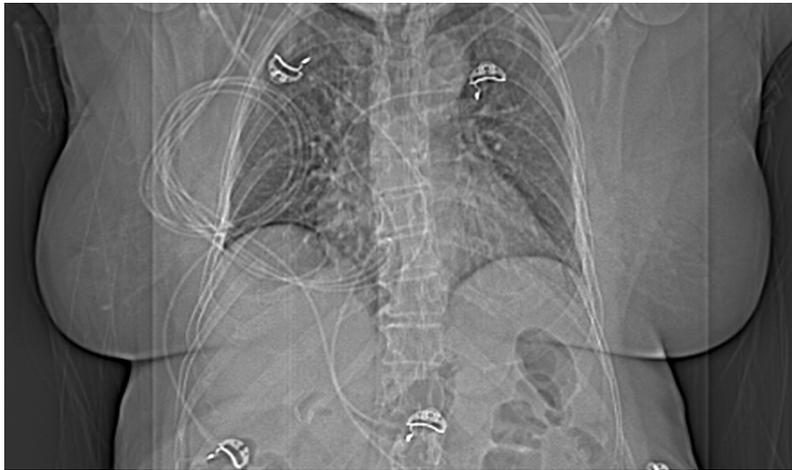
- ¹ World Health Organization.
<http://www.who.int/mediacentre/factsheets/fs334/en/>
- ² J Nucl Cardiol. 2017 Aug;24(4):1402-1426.
doi: 10.1007/s12350-017-0926-8. Epub 2017 Jun 5.
- ³ Nakajima K, Okuda K, Momose M, et al.
IQ•SPECT technology and its clinical applications using multicenter normal databases. *Annals of Nuclear Medicine*. 2017;31(9):649-659. doi:10.1007/s12149-017-1210-3.

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Examination protocol

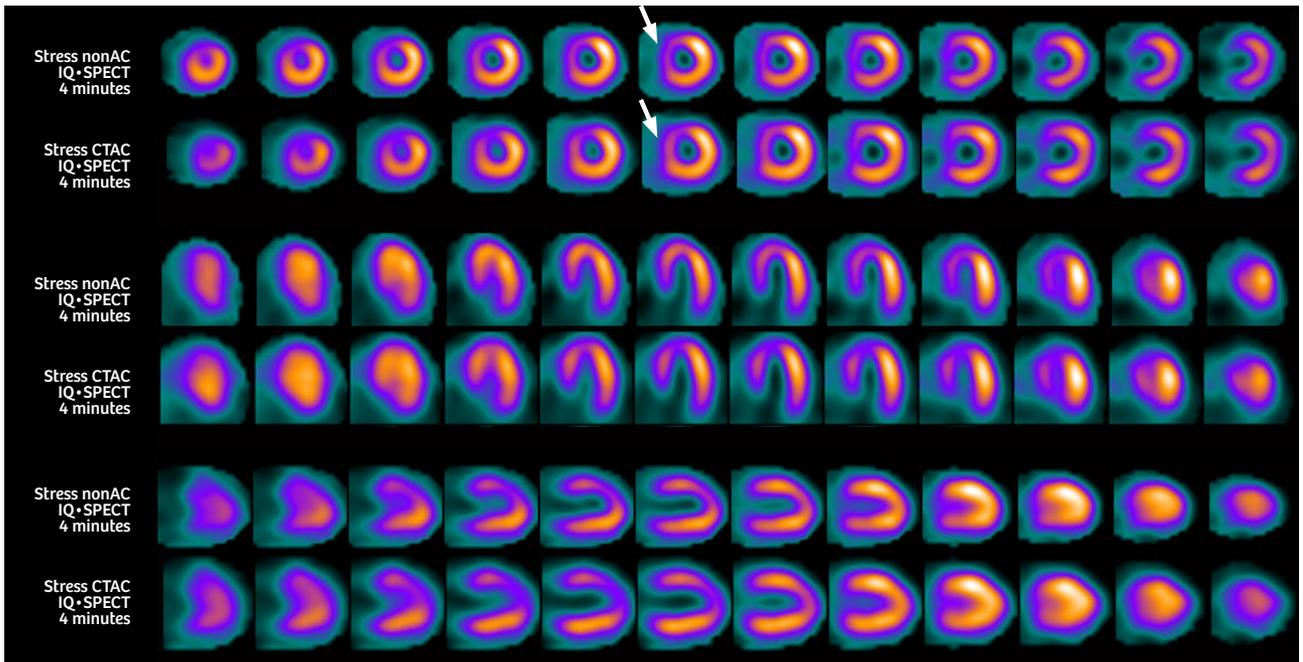
Scanner: Symbia Intevo 2

| SPECT | | |
|-------------------|----------------|---|
| Injected dose | Stress Rest | 24.5 mCi (906 MBq) 9.0 mCi (333 MBq) |
| Scan delay | | 60 minutes |
| Acquisition | | 4 minutes |
| CT | | |
| Tube voltage | | 110 kV |
| Tube current | | 88 mAs |
| Slice collimation | | 0.5 mm |
| Slice thickness | | 4.0 mm |



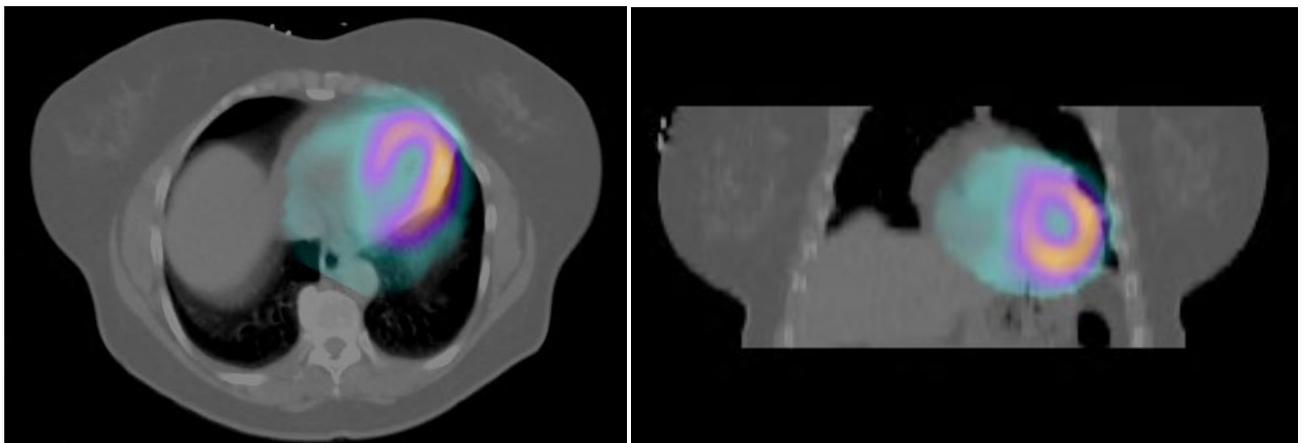
1 CT topogram demonstrating body habitus.

Data courtesy of Dr. Gary Marano, West Virginia University Medicine, Morgantown, WV, USA.



2 IQ-SPECT images acquired in only 4 minutes. Post CTAC IQ-SPECT images show correction of anterior septal wall attenuation artifact.

Data courtesy of Dr. Gary Marano, West Virginia University Medicine, Morgantown, WV, USA.



3 Axial and coronal view of fused CT and SPECT data show accuracy of image registration.

Data courtesy of Dr. Gary Marano, West Virginia University Medicine, Morgantown, WV, USA.

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