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Improving 99mTc-tetrofosmin Myocardial Perfusion Images by Time Subtraction Technique

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Abstract : Quantitative measurement of myocardium perfusion is possible with single photon emission computed tomography (SPECT) using a semiconductor detector. However, accumulation of ^{99m}Tc-tetrofosmin in the liver may make it difficult to assess that accurately in the inferior myocardium. Our idea is to reduce the high accumulation in the liver by using dynamic SPECT imaging and a technique called time subtraction. We evaluated the performance of a new SPECT system with a cadmium-zinc-telluride solid-state semi- conductor detector (Discovery NM 530c; GE Healthcare). Our system acquired list-mode raw data over 10 minutes for a typical patient. From the data, ten SPECT images were reconstructed, one for every minute of acquired data. Reconstruction with the semiconductor detector was based on an implementation of a 3-D iterative Bayesian reconstruction algorithm. We studied 20 patients with coronary artery disease (mean age 75.4 ± 12.1 years; range 42-86; 16 males and 4 females). In each subject, 259 MBq of ^{99m}Tc-tetrofosmin was injected intravenously. We performed both a phantom and a clinical study using dynamic SPECT. An approximation to a liver-only image is obtained by reconstructing an image from the early projections during which time the liver accumulation dominates (0.5~2.5 minutes SPECT image-5~10 minutes SPECT image). The extracted liver-only image is then subtracted from a later SPECT image that shows both the liver and the myocardial uptake (5~10 minutes SPECT image-liver-only image). The time subtraction of liver was possible in both a phantom and the clinical study. The visualization of the inferior myocardium was improved. In past reports, higher accumulation in the myocardium due to the overlap of the liver is un-diagnosable. Using our time subtraction method, the image quality of the ^{99m}Tc-tetorofosmin myocardial SPECT image is considerably improved.

Keywords : 99mTc-tetrofosmin, dynamic SPECT, time subtraction, semiconductor detector
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