Hyperemic myocardial blood flow quantification with CZT-based SPECT cameras and a rapid, single-scan rest/stress scan

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Abstract

This protocol describes how to calculate the hyperemic myocardial blood flow, a clinically critical parameter, with CZT-based SPECT and a single-scan rest/stress protocol that is proposed in our manuscript.

Citation: Yu-Hua Fang Hyperemic myocardial blood flow quantification with CZT-based SPECT cameras and a rapid, single-scan rest/stress scan. **protocols.io**
dx.doi.org/10.17504/protocols.io.iqjcdun
Published: 29 Jun 2017

Materials

- 99mTc-Sestamibi by Contributed by users
- dipyridamole by Contributed by users

Protocol

Step 1.

The first portion of the protocol describes the scan and data acquisition as follows.

Step 2.

A subject under study was first injected with 10 mCi of 99mTc-Sestamibi under resting conditions as a bolus intravenous injection.

Step 3.

After permitting uptake for 60 minutes, the subject was placed on the scanner table and a technologist carefully adjusted the patient position via scintigraphy such that the heart was placed at the center FOV.

Step 4.

Once the patient was appropriately positioned, data acquisition was initiated in list-mode and continued for 24 minutes.

Step 5.

After 5 minutes of scanning, the subject was pharmaceutically stressed with 0.142 mg/kg/min of dipyridamole that was slowly infused over 4 minutes.

Step 6.

Five minutes after the end of dipyridamole infusion, 20 mCi of 99mTc-Sestamibi was intravenously

injected as a bolus.

Step 7.
The scan was terminated 10 minutes after the second tracer injection.

Step 8.

The second portion of the protocol describes the data analysis procedures.

Step 9.
When a region of interest (ROI) was drawn and the corresponding time-activity curve was obtained, the first 5 minutes of the TAC included the activity from purely the resting state. To exclude the effect of residual activity in the resting state from the stress portion, the mean activity of the first 5 minutes was calculated and then subtracted from the whole TAC.

Step 10.
To obtain the input function required for kinetic modeling analysis, a region of interest (ROI) was drawn in the left ventricular (LV) cavity over a short-axis slice. The residual activity of the rest acquisition was subtracted from that of the stress acquisition.

Step 11.
Once the tissue stress TACs were determined for the LV and myocardium, the tissue TACs were fitted with a two-tissue-compartment model using the LV TACs as input functions with the COMKAT software. The estimated kinetic rate constant K1 was used to approximate the hyperemic MBF.