myocardial studies [3,4]. The main limitations of this technique are poor resolution of the ^{18}F and ^{99m}Tc SPECT images and, when acquired simultaneously, degradation of the ^{99m}Tc MIBI images due to ^{18}F downscatter to the ^{99m}Tc window. The ^{18}F images are also influenced by high septal penetration and poor sensitivity, due to the limited stopping power of the detector crystal in standard gamma cameras [5]. In PET centres without a cyclotron, sequential Rubidium-82 (^{82}Rb) and ^{18}F FDG perfusion/viability myocardial imaging are the most appropriate, because of the availability of both isotopes [6-10]. ^{82}Rb is a potassium analog that, like Thalium-201, is extracted by living cells. It is produced from a commercially available, FDA approved strontium-82 generator, which must be replenished 13 times a year. The short half-life of ^{82}Rb allows repeated acquisitions every 10 minutes. Neither, ^{18}F FDG or ^{82}Rb require expensive on-site cyclotrons, as are needed with ^{13}N ammonia and ^{15}O oxygen. Also, most health care providers reimburse for ^{82}Rb perfusion imaging, and more recently for ^{18}F FDG viability myocardial imaging.

The objective of our work was to compare ^{18}F SPECT with PET in myocardial perfusion/viability imaging in the classification of simulated myocardial defects for "viability" according to commonly applied criteria.

Methods

A nonuniform RH-2 thorax-heart phantom (Kyoto Scientific Speciment Co., LTD, Kyoto, Japan) (Fig. 1) was used in SPECT and PET acquisitions. Three inserts, 3 cm, 2 cm and 1 cm in diameter, were placed in the left ventricular (LV) wall to simulate small transmural infarcts (Fig. 2).

SPECT acquisitions were performed on a dual headed system (T22 gamma camera, SMV, Twinsburg, Ohio) with ultra-high-energy (UHE) collimator. The energy resolution of the system at 140 keV is 9.8%, and at 511 keV is 7.8%. The thickness of the NaI(Tl) crystal is 0.9525 cm (3/8"). A step-and-shoot mode was used for SPECT acquisitions, with a 64 × 64 acquisition and processing frame matrix size and zoom of 1.5. The time per frame was 40 sec. The 64 frames were acquired over 360°. The radius of rotation for the phantom study was 21 cm, which is also a typical radius for our clinical SPECT acquisitions. The pixel size in the acquisition and reconstructed images was 6.08 mm. SPECT data were processed using standard reconstruction software based on a filtered backprojection method. A Butterworth filter of 5th order and cut-off frequency of 0.25 cycles/pixel was used in the reconstruction for all studies. Neither attenuation nor scatter correction was performed.

The UHE parallel-hole collimator, used for the ^{18}F SPECT imaging, has hexagonal holes 3.4 mm in diameter and 65.0 mm in length, with a septal thickness of 3.0 mm. The collimator cores are mounted in an all-lead frame designed for 511 keV imaging. Planar resolution as a function of distance for the UHE collimator, measured in air with a ^{99m}Tc point source was FWHM = 3.9 mm, 10.6 mm, and 14.0 mm for 0 cm, 10 cm and 15 cm distance, respectively. The same planar resolution measured with an ^{18}F point source gave FWHM = 5.3 mm, 13.9 mm, and 18.2 mm for 0 cm, 10 cm and 15 cm distance, respectively [11]. The standard deviation was less than 0.5 mm in all measurements and was obtained from three measurements. This shows that planar resolution for the UHE collimator is better for ^{99m}Tc than for ^{18}F. Septal penetration for the UHE collimator is 6.5% and for the low-energy-high-resolution collimator is 0.50% [5]. The quoted septal pene-

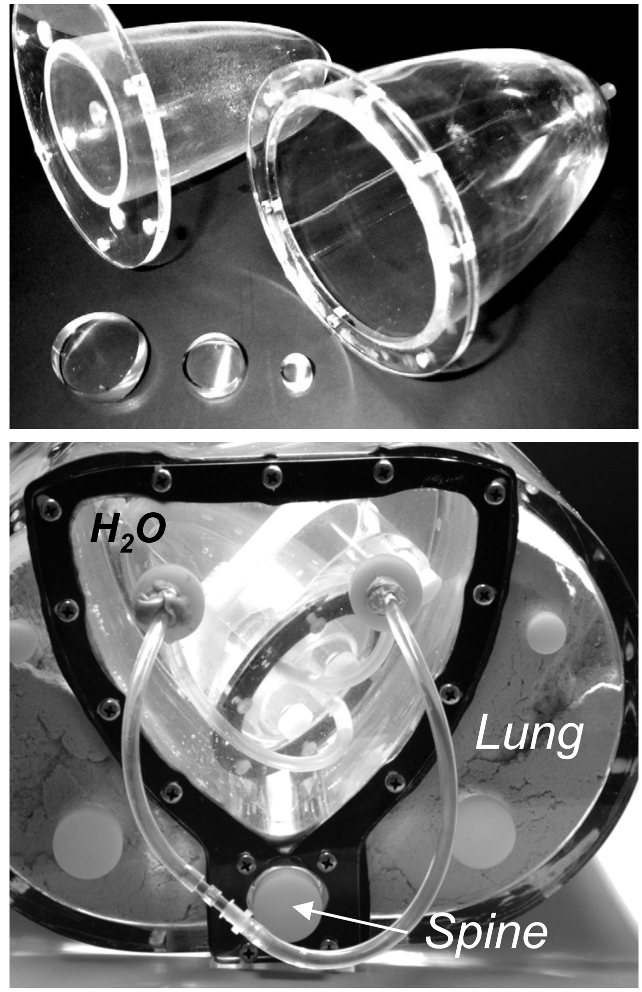

Figure 1
RH-2 thorax-heart phantom. A) In a left ventricular wall three inserts, 1 cm, 2 cm and 3 cm in diameter were placed in the same short-axis plane. B) Cardiac phantom is placed in water. Left ventricular wall is connected by Teflon tubes to remote filling system. Teflon rod simulates spine and sawdust simulates lungs.