Myocardial perfusion imaging is feasible for infarct size quantification in mice using a clinical single-photon emission computed tomography system equipped with pinhole collimators.

Abstract:

The aim of this study is to evaluate a non-invasive method for measuring myocardial perfusion defect size in mice using a clinical single-photon emission computed tomography system equipped with pinhole collimators (pinhole SPECT). Thirty days after ligation of the left anterior descending coronary artery, 13 mice (C57BL/6J) were imaged following intravenous injection of 370 MBq [99mTc]sestamibi. Eight control mice without myocardial infarction were likewise investigated. Image quality optimization had been achieved by repeated scanning of a multiple point phantom, with varying zoom factors, number of projection angles, and pinhole diameter. Volumetric sampling was used to generate polar maps, in which intensity was normalized to that of a standard septal region of interest (ROI), which was set at 100%. Receiver operating characteristic analyses were performed to define an optimal threshold as compared to histologically measured defect sizes, which were considered as gold standard. A spatial resolution of 1.9 mm was achieved using a pinhole diameter of 0.5 mm, a zoom factor of 2, and 6 degrees projection angles. Histological results were best reproduced by a 60% threshold.
relative to the septal reference ROI. By applying this threshold, SPECT perfusion defect sizes revealed very high correlation to the histological results ($R^2 = 0.867$) with excellent intra- and interobserver reproducibility (intraclass correlation coefficients of 0.84 and 0.82). We achieved a spatial resolution of 1.9 mm in myocardial perfusion imaging in mice using a clinical SPECT system mounted with pinhole collimators. Compared to a histological gold standard, the infarct sizes were accurately estimated, indicating that this method shows promise to monitor experimental cardiac interventions in mice.