Dual-energy computed tomography for the detection of late enhancement in reperfused chronic infarction: a comparison to magnetic resonance imaging and histopathology in a porcine model.

To evaluate the performance of late enhancement dual-energy CT (LE-DECT) for the detection of infarcted myocardium as compared with 1.5-T late enhancement magnetic resonance imaging (LE-MRI) in a porcine model of reperfused chronic myocardial infarction (MI), using histopathology as standard of reference. In 8 healthy minipigs, MI was induced by 30-minute balloon occlusion of the left anterior descending coronary artery. Sixty-one ± 4 days after left anterior descending coronary artery occlusion, LE-DECT was performed 5, 10, and 15 minutes subsequent to contrast material injection. Therefore, a dual-source CT scanner (Somatom Definition, Siemens Healthcare, Forchheim, Germany) was used in dual-energy mode with the following protocol: tube potential/current 140 kV/95 mAs on tube A and 100 kV/165 mAs on tube B, collimation 2 × 32 × 0.6 mm, 1.5 mL/kg contrast material injected at 3 to 4 mL/s. Myocardial iodine distribution was calculated from the dual-energy data and superimposed on the gray scale multiplanarreformats of the heart in short-axis view. Fifty ± 12 minutes after LE-DECT imaging, 1.5-T LE-MRI (Magnetom Avanto, Siemens Healthcare, Forchheim, Germany) was performed 10 minutes successive to injection of contrast material using...
phase-sensitive inversion recovery sequences. For all pigs investigated, 2,3,5-triphenyltetrazolium chloride staining and histopathology of stained-tissue samples were acquired. Two experienced radiologists assessed all imaging studies in a random manner and were blinded to the results of the other techniques for the presence of late enhancement (LE). The American Heart Association 17-segment model was used to compare the results of LE-DECT, 100 kV grayscale LE images, LE-MRI, and histopathology. Size of MI was calculated for histopathological findings, LE-MRI, LE-DECT, and 100 kV grayscale LE images 10 minutes after contrast agent injection. Agreement between infarct size assessed with imaging modalities and histopathology was evaluated with Bland-Altman analysis. Of the 136 myocardial segments in 8 minipigs, histopathology found MI in 27 segments. Diagnostic per-segment sensitivities and specificities for 100 kV grayscale LE images, LE-DECT images, and MR images obtained 10 minutes after contrast agent injection for both the readers were 0.62, 0.77, 0.79 and 0.97, 0.92, 0.94, respectively. Although sensitivities were higher for LE-DECT and LE-MRI than for 100 kV grayscale images, no statistically significant difference for the diagnostic accuracies of 100 kV grayscale LE images, LE-DECT images, and MR images (0.9, 0.89, 0.9) existed 10 minutes successive to contrast agent injection (all P> 0.05). Infarct size for LE-MRI, LE-DECT, and 100 kV grayscale LE images correlated well with histopathological findings (r = 0.97, 0.96, and 0.94; all P< 0.01). This feasibility study shows a high accuracy and a good correlation of LE-DECT and LE-MRI to histopathology for the detection of LE in a porcine model of reperfused chronic MI.

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