Title:
Volumetric RECIST: An Improved Way to Assess Tumor Response after Transcatheter Arterial Chemoembolization (TACE)

Abstract:
Purpose:
Multi-phasic contrast-enhanced MRI is the gold standard to diagnose liver tumors and assess treatment response. One of the ways to assess response is based on changes in size (RECIST criteria). Although widely accepted, RECIST has a number of limitations in its current state. In RECIST, tumors are measured on one representative axial slice of the tumor. As a result, a different slice selection can lead to a different response assessment. Furthermore, the measurement usually only comprises longest and shortest diameters on this slice. We propose to improve the RECIST criteria by calculating the exact tumor volume rather than using one representative slice. We propose this as volumetric RECIST (vRECIST).

Method and materials:
vRECIST was calculated as follows: 1) A semi-automatic 3D tumor segmentation using non-Euclidean radial basis functions was performed on the 20-sec scan. The time required to segment the tumor was recorded. 2) The volume was calculated based on this segmentation. vRECIST was performed on 4 patient cases with hepatocellular carcinoma before and after drug-eluting beads transcatheter arterial chemoembolization (DEB-TACE).

Results:
Segmenting the 8 MRI examinations took 82±53 seconds (range 40-200 seconds). The tumor volumes (vRECIST) were found to be in the range of 15.9-952.0cm³ and 8.0-1300.0cm³ for pre- and post-DEB-TACE, respectively.

Conclusion:
vRECIST greatly reduces variability and captures the entire tumor volume. This is important because one representative axial slice is typically not adequate to assess tumor response. The slice chosen may not be in the largest axial dimension, or the tumor may have changed in other axial slices (asymmetric regression). In addition, different radiologists can choose different representative slices, leading to significant inter-observer variability. By calculating and observing changes in the entire tumor volume, this variability is eliminated.