Myocardial T2-Mapping and T2-value Measurement using Breath-hold Gradient- and Spin-echo (GRASE) imaging: Comparison with Navigator-gated Spin-echo Imaging

Yasuo Amano1, Yoshiaki Komori2, Masaki Tachi1, Hitomi Tani1, Tetsuro Sekine1, and van Cauteren Marc2

1Nippon Medical School, Tokyo, Tokyo, Japan, 2Philips Electronics Japan, Tokyo, Japan

Introduction: Myocardial T2-mapping and T2-value measurement using cardiac MRI are valuable for assessment of iron-overload on the myocardium and myocardial edema or inflammation. Because of the use of ECG-gating and respiratory compensation, the myocardial T2-mapping and T2-value measurement using spin-echo (SE) imaging is time-consuming. Gradient- and spin-echo (GRASE) imaging has been used to measure T2-value of the knee cartilage. We proposed to perform ECG-gating breath-hold GRASE imaging for the generation of the T2-mapping and the measurement of the T2-values of the myocardium and compared them with those acquired by the SE imaging.

Methods: Nineteen patients with varied myocardial diseases, who had no history of hemosiderosis and iron-overload, were enrolled. A 3.0-T unit and 6-channel multi-coil were used, and navigator-gated SE and breath-hold GRASE were performed to generate the myocardial T2-mapping and to measure the myocardial T2-values. Both SE and GRASE techniques used ECG-gating, black-blood preparation per 1 RR, and 5-multiecho-time acquisition (i.e., 20, 30, 40, 50, and 60 ms). The GRASE was acquired with the 3, 5, or 7-multishot acquisition. The in-plane spatial resolution of the SE and GRASE was 2.97 x 3.30-3.58 mm2, and the slice thickness was 5mm. Sensitivity encoding was applied to all sequences.

Image homogeneity of the myocardium was evaluated on the myocardial T2-mapping generated from the SE and GRASE visually. The myocardial T2-values of the interventricular septum and left ventricular lateral wall were measured using region-of-interest method (including 14 pixels at least), and the differences and correlations for these values were analyzed between the SE and GRASE imaging.

Results: Image homogeneity of the myocardium did not differ between SE and GRASE (Figures). However, the respiratory artifacts were significant in 3 of the 19 patients in the navigator-gated SE images. GRASE required 15-25 sec breath-hold, and no respiratory artifacts were observed. There were no significant differences in the myocardial T2-values between SE and GRASE. There were significant correlations for the T2-values of the septal myocardium between SE and GRASE, and the r-value was highest between SE and GRASE with the multishot acquisition = 3 (r = 0.82: Table). The myocardial T2-values of the left ventricular lateral wall varied largely.

Conclusion: GRASE with the multishot acquisition = 3 provided the T2-mapping with few artifacts and the myocardial T2-values comparable to those acquired by SE imaging during the acceptable breath-holding time.


Table: Correlation of myocardial T2-values between SE and GRASE

<table>
<thead>
<tr>
<th>GRASE (3)</th>
<th>GRASE (5)</th>
<th>GRASE (7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>r for SE septal</td>
<td>0.82</td>
<td>0.57</td>
</tr>
<tr>
<td>lateral</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

Figures
T2-mapping generated from SE and GRASE (multishot=3). The image homogeneity of the myocardium is not significant and does not differ between the two images.