

Delineating Myocardial Edema and Hemorrhage using T2, T2*, and Diastolic Wall Thickness Post Acute Myocardial Infarction at 2 Early Time Intervals

M. I. Zia¹, N. R. Ghugre¹, G. A. Paul¹, J. A. Stainsby¹, V. Ramanan¹, K. A. Connelly¹, G. A. Wright¹, and A. J. Dick¹
¹Sunnybrook Health Sciences Centre, Toronto, ON, Canada

Objective: Our goal was to demonstrate myocardial edema using T2 spiral and diastolic wall thickness (DWT) and myocardial hemorrhage using T2* in patients post acute myocardial infarction (AMI) at 48 hours and 3 weeks.

Background: Enhanced T2, often identified with area at risk (AAR), combined with consideration of T2* and DWT may facilitate interpretation of potentially complex patterns of myocardial damage and tissue response infarction zones.

Methods: Patients were enrolled post AMI (creatinine kinase >500 IU/L) and underwent CMR on a GE Signa Excite, 1.5T scanner with a 8-channel receive coil at 48 hours and 3 weeks post MI. T2 maps were computed from a previously validated cardiac-gated spiral imaging sequence with T2 preparations yielding TEs=2.9,24.3,88.2,184.2 ms to assess myocardial edema. The T2* sequence was a multiecho acquisition with 8 echoes (between 1.4 and 12.7ms) acquired at TR=14.6ms. T2-weighted imaging using a breath-hold triple IR fast spin echo sequence and delayed hyperenhancement (DHE) were also performed.

Results: Nine patients (mean age: 57.3 years; 8 males, 1 female; 6 right coronary artery, 2 left circumflex artery and 1 left anterior descending artery percutaneous coronary interventions) have been enrolled. At 48 hours, both the mean T2 (54.4 ms vs 40.6 ms; $p<0.01$) and mean DWT (8.1mm vs 6.3mm; $p=0.01$) were significantly higher in the infarcted segment (IS) compared to a remote segment (RS). Figure 1 demonstrates the evolution of T2 and T2* behavior over time. At 48 hours, panel-a demonstrates a modestly increased T2 of 51 ms in the IS suggesting myocardial edema, relative to RS with a T2 of 40 ms. However, there is also evidence of myocardial hemorrhage on T2*-weighted images (panel-b, arrow) along with microvascular obstruction on DHE (panel-c). The difference in DWT between IS and RS was 3.3 mm. At 3 weeks, the T2 in the IS increased to 58 ms compared to a RS T2 of 40 ms (panel-d). At this time, there is evidence of less hemorrhage on T2*-weighted images (panel-e, arrow), a reduced area of microvascular obstruction on DHE (panel-f) and a reduced difference in DWT of 0.7 mm between IS and RS.

Conclusions: Assessing the presence and evolution of edema and myocardial hemorrhage early post AMI demonstrates distinct patterns. If myocardial hemorrhage is present, then early scans are affected by the competing effects of T2*, counteracting an increased T2 signal. This may be important in accurately quantifying AAR and identifying those patients most likely to suffer deleterious left ventricular remodeling.

