T2 MAGNETIC RESONANCE IMAGING OF MYOCARDIAL EDEMA

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Disease or Problem Based Teaching, Practical Protocols: Advanced

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T2 relaxation time has been linked to water content since the earliest magnetic resonance experiments in tissues (Bottomley 1984). Numerous technical advances have led to T2-weighted imaging and quantitative T2 mapping of the myocardium *in vivo*. These techniques will be reviewed along with the clinical indications and investigative settings in which they are used.

In spin echo acquisitions, T2-weighted (T2W) imaging results from long echo and repetition times (TE, TR); free water is the major contributor to T2 signal intensity in the resulting image (Abdel-Aty 2007). More rapid i.e. fast spin echo acquisitions have made single heartbeat T2W imaging feasible, though image quality still varies. Triple-inversion recovery and STIR techniques require multiple heartbeats and breathholding, but offer greater sensitivity to tissue water content along with fat suppression. T2 mapping offers a quantitative alternative to qualitative interpretation of T2W images; adding motion correction algorithms makes the resulting maps impervious to artifact that may result from cardiac and respiratory motion even with 3 single-heartbeat acquisitions.

The first demonstration that myocardial ischemia produced increased tissue water content was done by Reimer and Jennings in the 1970s. Their careful wet- and dry-weight measurements along with histopathological examination of explanted myocardium provided the essential mechanistic underpinnings for the most recent *in vivo* studies in patients with acute coronary syndromes. Further preclinical studies have shown that T2W cardiac magnetic resonance imaging (CMR) can identify 'myocardium at risk' (Aletras 2006), and that myocardial T2 enhancement may occur in the absence of evidence of myocardial necrosis using conventional serum biomarkers (Abdel-Aty 2009). Clinical studies have shown utility of T2W CMR in detecting acute coronary syndromes in emergency department patients (Cury 2008), and ongoing studies suggests utility in therapeutic decision-making once the diagnosis of ACS has been made.

Literature Cited

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