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Meeting abstract

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403 Do heart rate, ejection fraction, stroke volume and cardiac output play a key role in optimal myocardial nulling?

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Introduction

It is a known fact that utilizing the proper inversion time (TI) is essential in diagnosing myocardial infarctions. Many factors play a key role in acquiring optimal nulling of the myocardium. We have shown that the amount of gadolinium dosage administered plays a major role on TI. It has been shown that a low gadolinium dosage will yield a higher TI while a high dosage results in a lower TI. The current conditions relating to the intrinsic contraction factors of the heart and their contribution to TI are currently unknown. For instance, how fast are the wash in/wash out kinetics in a patient with a high heart rate and a low ejection fraction?

Hypothesis

We hypothesize that the heart rate, ejection fraction, stroke volume and cardiac output are important factors in determining optimal myocardial nulling.

Methods

Thirty-one (31) patients (22 M, 9 F), age 42–82 years, 29 post-myocardial infarction and 2 with coronary artery disease (CAD) underwent a standard cardiac MRI (CMR). Patients represented a wide range of routine cardiovascular parameters: heart rate (47–104 bpm), ejection fraction (11–50%), stroke volume (102–131 ml) and cardiac output (2.0–11.9 ml/min). A 0.2 mmol/kg gadolinium dosage (Magnevist-Berlex, New Jersey, USA) given at 5 ml/sec through a peripheral (brachiocephalic vein) was used to evaluate myocardial viability. The scans were acquired on a GE CV/i Excite Version 12, 1.5 T system (GE, Milwaukee, WI). The sequence utilized for optimum myocardial nulling was a standard 2D Gradient Echo IRP (FGR with inversion recovery prep) with manual selection of TI. An 8-channel or 4-channel cardiac coil was used. The sequence parameters were as follows: TE: min, FA: 20, NEX: 2 trigger delay: adjusted to onset of diastole, 1 RR interval and TI adjusted to null the myocardium. This sequence was performed at 10 and 20 minutes post-gadolinium.

Results

All patients successfully completed the CMR examination without any difficulty. Particular focus was placed on the heart rate, ejection fraction, stroke volume, and cardiac output to observe their effects on the inversion time (TI) of the myocardium. The data analysis demonstrated that there was no significant correlation between TI at 10 min or at 20 min on heart rate ($r = .34$, $r = .13$), stroke volume ($r = .30$, $r = .46$) or cardiac output ($r = .16$, $r = .46$). There was a trend between heart rate and TI 10, $F(1, 29) = 3.9$, $p = 0.058$, which showed an inverse relationship. There was a trend for correlation between stroke volume and TI 10 ($F(1, 28) = 3.0$, $p = 0.10$). However, there was a strong positive correlation between LVEF and inversion time TI 10 ($F(1, 29) = 19.2$, $p < 0.001$). Thus, approximately 38% of the variability for TI 10 time was accounted for by

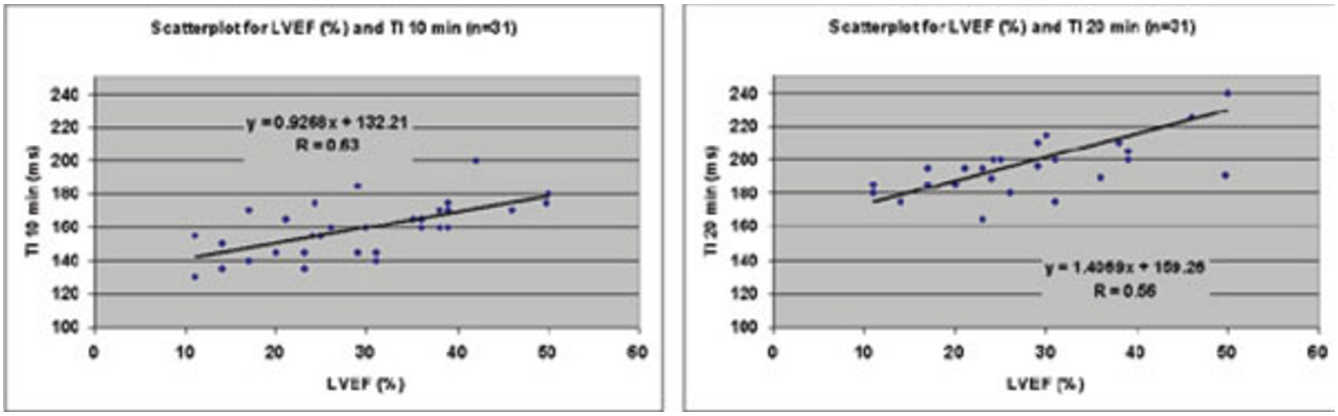

Figure 1

LVEF%. There was also a positive correlation at 20 min post gadolinium (p = 0.0002). (See Figure 1.)

Conclusion

Additional knowledge relating to non-gadolinium based mechanics may be essential to arrriving at the optimal TI for myocardial nulling and perhaps crucial for accurate patient diagnosis. Conditions relating to the cardiac conditions at time of DHE exam were evaluated. Surprisingly, neither heart rate nor stroke volume significantly impacted the null time, whereas the LVEF did. This observation suggests that the resident time of the gadolinium is driven by the ejection fraction such that the rate of blood pool delivery is *not* the crucial aspect, but it is directly responsible for '*pushing*' the gadolinium out of the myocardium; i.e, a patient with a high LVEF permits faster extraction of gadolinium out of the myocardium, leading to a lower gadolinium concentration, thus a higher TI time. This knowledge, combined with the known dosage relationships, can better guide us to arrive at the optimal TI.