

Relationship Between Three-Dimensional Myocardial Strain and Non-contrast Tissue Mapping by Cardiac Magnetic Resonance Imaging In Patients Receiving Anthracycline-based Chemotherapy

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Abstract Character Count: 1973

Background

Current imaging surveillance techniques for anthracycline-related cardiotoxicity are focused on the assessment of 2D left ventricular mechanics to identify myocardial injury. In this study we investigate the feasibility and preliminary findings of a combined 3D myocardial strain / native tissue mapping protocol in patients receiving Anthracycline- based chemotherapy

Methods

Nineteen patients planned for Anthracycline-based chemotherapy (14 Breast cancer and 5 Lymphoma) were recruited and underwent serial imaging using CMR at baseline, 3 and 6-months post induction. Multi-planar cine imaging and T1 mapping was used to obtain T1 maps, LV volumes, and LV mass. 3D strain analysis was performed using custom in-house software (GIUSEPPE). Global and segmental values of strain and T1 were analyzed versus baseline values.

Results

Mean age was 49.0±12.3 years with 16 (84%) being female. Cumulative Anthracycline dose at 6 months was 534±120 mg/m². Mean baseline LVEF was 61.3±5.6% with a reduction at 6 months of 3.5±8.8% (p=0.14). LVEDV and LVESV indexed to BSA showed significant elevations at 6 months (13.1±16.1%, p=0.0015, and 12.8±23.1%, p=0.0050, respectively). Significant reductions (p<0.05) in global strain was seen in circumferential and longitudinal directions at 6 months with corresponding elevations in longitudinal, minimum principal and maximum principal time to peak strain. Strain rate was significantly reduced at 6 months for circumferential (p=0.0002), longitudinal (p=0.0003), radial (p=0.021), minimal principal (p=0.002) and maximal principal (p=0.007) directions (Figure 1). Segmental analysis revealed a geographic reduction in strain as shown in figure 1. Non-contrast T1 rose significantly at 6 months (5.5±8.9%, p=0.03) congruent with strain alterations.

Conclusion

Cardiac MRI identified significant alterations in LV volume, myocardial strain and myocardial T1 over the first 6 months of Anthracycline exposure despite no appreciable change in LVEF. The utility of multi-parametric CMR for cardiotoxicity surveillance warrants further investigation.

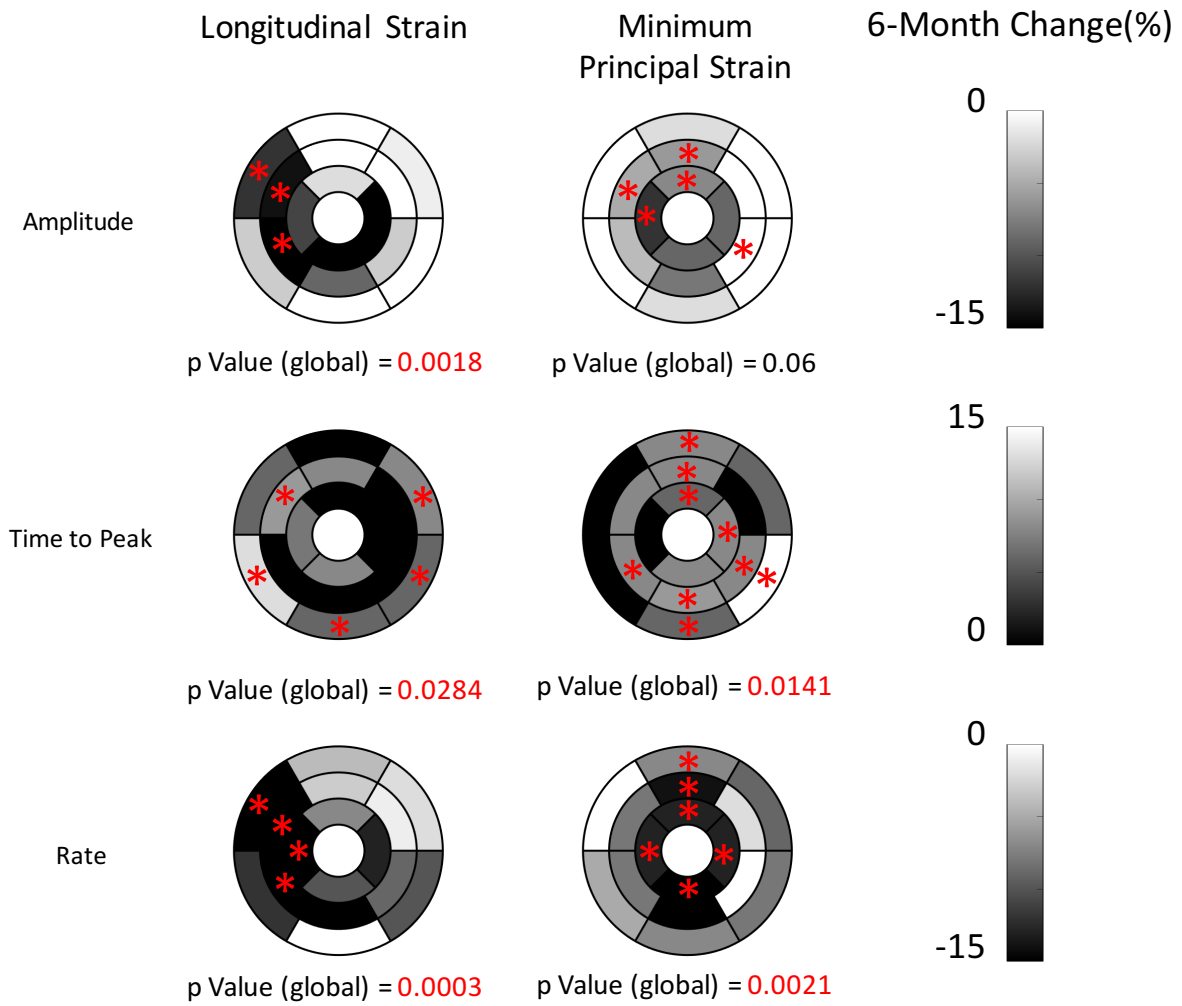


Figure 1: Global and Regional changes of baseline-indexed strain amplitude, time to systolic peak and rate at 6 months after chemotherapy with respect to baseline. * $p < 0.05$