Journal of Cardiovascular Magnetic Resonance

BioMed Central

Poster presentation

Open Access

Systematic method for cleaning circumferential strain from raw harmonic phase magnetic resonance imaging (HARP) analyzed data

Susan A Matulevicius*, Colby R Ayers, Roderick McColl and Ronald M Peshock

Address: University of Texas Southwestern, Dallas, TX, USA

* Corresponding author

from 13th Annual SCMR Scientific Sessions
Phoenix, AZ, USA. 21-24 January 2010

Published: 21 January 2010

Journal of Cardiovascular Magnetic Resonance 2010, **12**(Suppl 1):P233 doi:10.1186/1532-429X-12-S1-P233

This abstract is available from: http://jcmr-online.com/content/12/S1/P233

Introduction

Analysis of cardiac tissue tagging strain measurements can be prone to noise secondary to tag fading, through plane motion, and other imaging artifacts.

Purpose

We propose a method for systematically removing outlier data points to improve reproducibility of circumferential strain measurements as well as better model the physiologic behavior of the myocardium.

Methods

Spatial Modulation of Magnetization tissue tags were placed on the myocardium at 3 T in 400 participants in the Dallas Heart Study. Short-axis tagged slices were analyzed by the harmonic phase (HARP) method (Diagnosoft, Palo Alto, California) to assess circumferential strain. The raw segmental data at each phase (24 points per wall/phase) was evaluated by the Shapiro-Wilk test for normality. If the strain at a given phase was not normally distributed (Shapiro-Wilk test $p < 0.05$), outlier points, defined as any value less than the 25th percentile -1.5× the interquartile range or greater than the 75th percentile +1.5× the interquartile range, were removed. The mean strain value at each phase was then calculated for cleaned data and compared with raw data. 10 participants were randomly selected for intra- and inter-observer variability calculations. Interclass correlation coefficients were calculated for peak systolic strain in each wall to compare intra- and inter-observer variability. The mean and standard of peak systolic strain was calculated for the entire cohort from both the raw and cleaned data and the percentage of participants with > 5 or < -5% strain at the end of diastole in clean vs. raw data was compared.

Results

Cleaning improved both intra-observer and inter-observer reproducibility (Table 1). Cleaning also decreased the proportion of participants in the total sample who had strain values > 5% or < -5% in late diastole (Table 2). The standard deviation in peak systolic strain values was decreased after cleaning (Clean vs raw: septum -18.5 ± 3.9% vs. -18.1 ± 4.4%; inferior -16.0 ± 3.3% vs. -15.5 ± 3.7%; lateral -20.5 ± 2.9% vs. -19.9 ± 3.2%; anterior -21.1 ± 3.1% vs. 20.6 ± 3.3%).

Conclusion

Systematic cleaning of raw HARP circumferential strain by removing outliers in non-normal distributions of strain at each phase improves inter- and intraobserver variability and decreases the proportion of participants in the total sample who had strain values > 5% or < -5% in late diastole.

Table 1: Intraclass Coefficients of Variability for peak Systolic Strain Intra- and Interobserver Variability

	Septal R^2	Pr > F	Inferior R^2	Pr > F	Lateral R^2	Pr > F	Anterior R^2	Pr > F
Intraobserver Raw	0.87	0.05	0.88	< 0.01	0.83	0.02	0.72	0.11
Intraobserver Clean	0.93	< 0.01	0.86	< 0.01	0.88	< 0.01	0.82	0.02
Interobserver Raw	0.93	< 0.01	0.64	0.24	0.83	0.02	0.66	0.21
Interobserver Clean	0.96	< 0.01	0.91	< 0.01	0.83	0.02	0.78	0.05

Table 2: Proportion of participants with systolic strain > 5% or < -5% in late diastole

	Septum	Inferior	Lateral	Anterior
Clean	54/400 (14%)	46/400 (12%)	116/400 (29%)	110/400 (28%)
Raw	104/400 (26%)	112/400(28%)	167/400 (42%)	170/400 (43%)