Layer-Specific Strain Analysis during Acute and Chronic Stages of Myocardial Infarction

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Non-transmural myocardial infarcts (MI) have been described to affect primarily the endocardial layer (Endo), while transmural MI usually affects the epicardial layers as well. Since it is important to reliably and quantitatively assess the extent of the MI damage, we investigated the hypothesis that measurement of endocardial circumferential strain (Sc), instead of the strain across the total-wall-thickness (TWT), will improve the detection and characterization of MI.

Twenty four rats underwent occlusion of the left anterior descending artery for 30 minutes, followed by reperfusion. Apical and papillary muscles levels of short-axis echo scans were performed at baseline, and at 24 hours post-MI (n=13) or two weeks post-MI (n=11). The scans were post-processed by a layer-specific speckle tracking echo program to measure the Sc at the Endo and for the TWT. Thereafter, the rats were sacrificed, and histological analysis of the MI size and transmurality was performed.

Twenty four hours post-MI, the results of receiver operating characteristics analysis for MI classification as transmural versus other segments, and as non-transmural versus non-affected segments yielded larger area-under-curve (AUC) for the peak Sc of the Endo than of the TWT (Table 1, $P<0.05$), while in the rats, analyzed two weeks post-MI the AUC was the same for peak Sc of the Endo and TWT.

The utilization of layer-specific peak Sc is advantageous over the assessments of peak Sc for the TWT in the detection and characterization of MI shortly after the event.

Table title - Detection of MI 24 hours post-MI

	Transmural MI (n=40). vs. other segments (n=115)		Non-transmural MI (n=38) vs. non-affected (n=77)		Transmural (n=40) vs. non-transmural MI (n=38)	
	Endo	TWT	Endo	TWT	Endo	TWT
AUC (mean± SE)	0.97±0.011	0.94±0.018*	0.93±0.023	0.83±0.041*	0.92±0.029	0.86±0.041
Sensitivity, %	93	93	92	76	93	93
Specificity, %	90	83	87	82	74	63

*P<0.05 difference from Endocardial strain.