Border Zone Pacing Improves Global and Regional Function as Assessed by Tissue Tagged MRI

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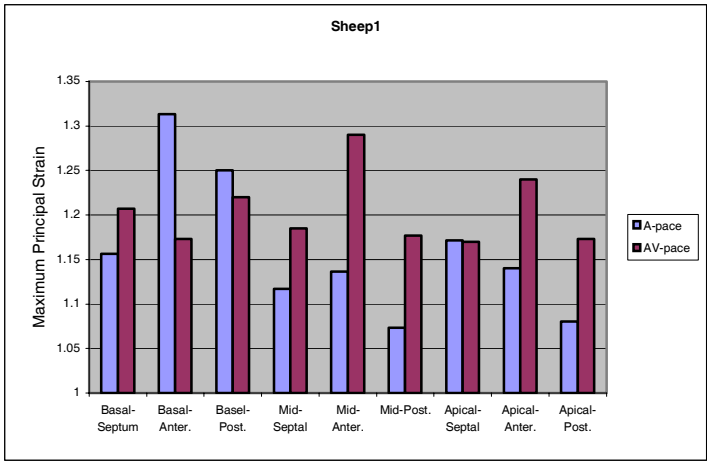
Introduction: The border zone region has been classified as a unique form of dysfunctional myocardium adjacent to an infarct that is normally perfused but has an abnormal systolic strain pattern (1). This abnormal strain has been theorized to result in a proliferation of the hypocontractility region to extend to involve progressively more normally functioning myocardium, resulting in ventricular dilatation and CHF (2,3). This study hypothesizes that pacing the border zone prior to the remote myocardium can normalize strain distribution, which could improve cardiac function and mitigate remodeling.

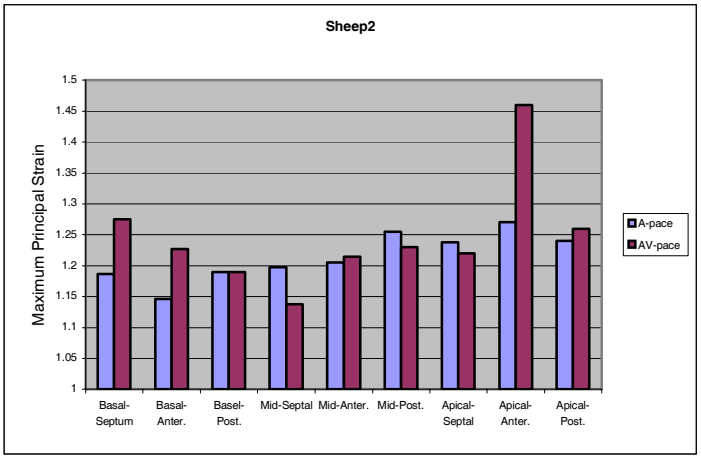
Methods: We used an ovine posterobasal infarct model combined with high temporal and spatial resolution tissue tagged MRI to characterize global and regional function during atrial (A-Paced) and atrial-ventricular pacing (AV-Paced). In two sheep an infarct was created via a left thoracotmy and custom designed pacing leads were placed on the mid-ventricular border zone and exteriorized. Immediately following infarction the animal was transported to the MRI and imaged using a 1.5T whole body scanner (Sonata, Siemens Medical Systems) with the following parameters. FOV 24cm x 24cm, TR/TE 7ms/2ms, Slice thickness 6mm, skip 0mm, 256 x128 matrix, 5mm tag spacing, ±64kHz bandwidth, 3 VPS, flip angle 15^0, NEX 2, cardiac and respiratory gating. Images were acquired during A-pacing and AV-pacing with a 40ms delay between the atrial and ventricular pacing spikes. Analysis was performed using a custom program based on an optical flow tracking method where the left ventricle was section into basal, mid-ventricular and apical each containing anterior, posterior, and septal regions resulting in a measure of volumes and maximum principal strain.

Results: Table 1 indicates that AV-pacing improved end-diastolic volumes (EDV), end-systolic volume (ESV), and ejection fraction (EF) in both animals with Sheep2 demonstrating a significant improvement. Global maximum principal strain, which is the strain over the entire ventricle, increased an average of 19.64% (Sheep1: 1.16 versus 1.20, Sheep2: 1.21 vs. 1.24). Maximum principal strain increased in a majority of regions in both animals with Sheep1 improving in 6 and Sheep2 in 5 with no change in one region for both animals (figure).

Conclusion: Early border zone pacing can improve global and regional myocardial strain during remodeling as assessed by tissue tagged MRI. This may be attributed to a decrease in the stroke work of the border zone resulting a more normal contraction pattern, which potentially could result in a diminished stimulus for infarct progression.

	Sheep1		Sheep2	
	A-Paced	AV-Paced	A-Paced	AV-Paced
EDV (ml)	48.9	46.6	51.8	47.5
ESV (ml)	28.2	26.2	42.5	36.5
EF (%)	42	44	18	23





References

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