

POSTER PRESENTATION

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Afterload quantitation for evaluation of myocardial strain

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From 17th Annual SCMR Scientific Sessions
New Orleans, LA, USA. 16-19 January 2014

Background

Systolic myocardial strain is load dependent, but the CMR literature largely disregards effects of myocardial afterload on strain and strain rate. This may reflect well known limitations of conventional myocardial afterload assessment using wall stress analyses, which are based on erroneous assumptions about left ventricular(LV) geometry and/or myocardial material properties. Therefore, we compared the utility of a nongeometric afterload index (NGI) derived from LV pressure(P) volume(V) and mass, which requires no assumptions about material properties, to that of conventional noninvasive end-systolic circumferential stress(CWS) as determinants of CMR LV circumferential strain(CST), ejection fraction(EF) and strain rate(SR) in normals(NL) and patients with nonischemic dilated cardiomyopathy(CM).

Methods

We obtained breath-hold volumetric short-axis SSFP cines, cuff systolic P, systolic duration, LVV, M and EF, feature-tracking global CST(TomTec Imaging Systems) and mean SR in NLs(n = 39, 46%female, age 54.6(sd14.6) yrs) and CM (n = 35, 23% female, age 50.8(sd15.0) yrs, EF 27.2%(sd10.8%). CWS was calculated using Mirsky's formula(Biophys. J.1969) while NGI was determined as end-systolic PV/M.

Results

EF, CST and CSR were markedly reduced in CM compared to NL(EF 27.2%(sd10.8)vs 58.4%(4.6), (-53%) p < 0.0001; CST -10.7%(5.3) vs -23.9%(4.3), (-55%), p < 0.0001);(CSR -32.1%/s(14.8) vs -65.7(14.9) p < 0.0001). But CWS was also markedly elevated in CM versus NL

(CWS 307.6(9.2) vs 176.2(42.1)x 103 dyn/cm2,(+75%), p < 0.0001). Thus afterload excess due to adverse LV remodeling, may account for most EF, strain and strain rate reduction in CM. However, PV/M was more markedly increased than CWS, (162.6(sd48.9) vs 84.4(18.4)(+93%) p < 0.0001) and correlated more closely and significantly with EF, CST and CSR than CWS in the expected inverse relationship in both NL and CM subgroups(Table 1). In stepwise regressions only PV/M was a significant correlate of EF, strain and strain rate in both subgroups.

Conclusions

Afterload excess due to adverse LV remodeling is an important determinant of reduced myocardial and LV chamber function in CM, making a major contribution

Table 1 Afterload Indices Versus EF, Strain and Strain Rate

	n	Spearman r	p
CWS vs EF NL	39	-0.29	ns
PV/M vs EF NL	39	-0.59	< 0.0001
CWS vs EF CM	35	-0.40	< 0.02
PV/M vs EF CM	35	-0.63	< 0.0001
CWS vs CST NL	39	-0.28	ns
PV/M vs CST NL	39	-0.46	< 0.003
CWS vs CST CM	35	-0.18	ns
PV/M vs CST CM	35	-0.49	< 0.003
CWS vs SR NL	39	-0.28	ns
PV/M vs SR NL	39	-0.40	0.012
CWS vs SR CM	35	-0.19	ns
PV/M vs SR CM	35	-0.51	< 0.002

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to reductions in EF, CST and SR, but PV/M, a simple, nongeometric afterload index, is superior to conventional wall stress calculation as a quantitative afterload index.

Funding

St. Francis Research Foundation.

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Published: 16 January 2014

doi:10.1186/1532-429X-16-S1-P320

Cite this article as: Reichek *et al.*: Afterload quantitation for evaluation of myocardial strain. *Journal of Cardiovascular Magnetic Resonance* 2014 16(Suppl 1):P320.

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