
BACKGROUND: Ventricular pacing can improve hemodynamics in heart failure patients, but direct effects on left ventricular (LV) function from varying pacing site and atrioventricular (AV) delay remain unknown. We hypothesized that the magnitude and location of basal intraventricular conduction delay critically influences pacing responses and that single-site pacing in the delay-activated region yields similar or better responses to biventricular pacing.

METHODS AND RESULTS: Aortic and LV pressures were measured in 18 heart failure patients (mean+/-SD: LV ejection fraction, 19+-7%; LV end-diastolic pressure, 25+/-8 mm Hg; QRS duration, 157+/-36 ms). Data under normal sinus rhythm were compared with ventricular pacing (VDD) at varying sites and AV delays (randomized order). Right ventricular (RV) apical or midseptal pacing had negligible contractile/systolic effects. However, LV free-wall pacing raised dP/dtmax by 23.7+/-19.0% and pulse-pressure by 18.0+/-18.4% (P<0.01). Biventricular pacing yielded less change (+12.8+/-9.3% in dP/dtmax, P<0.05 versus LV). Pressure-volume analysis performed in 11 patients consistently revealed minimal changes with RV pacing but increased stroke work and lower end-systolic volumes with LV pacing. Optimal AV intervals averaged 125+/-49 ms, and within this range, AV delay had less influence on LV function than pacing site. Basal QRS duration positively correlated with %DeltadP/dtmax (P<0.005), but pacing efficacy was not associated with QRS narrowing. Conduction delay pattern generally predicted pacing sites with most effect.

CONCLUSIONS: VDD pacing acutely enhances contractile function in heart failure patients with intraventricular conduction delay. Single-site pacing at the site of greatest delay achieves similar or greater benefits to biventricular pacing in such patients. These data clarify pacing-effect mechanisms and should help in candidate identification for future studies.