LEFT VENTRICULAR UNLOADING IMPROVES DYSSYNCHRONY BOTH DURING SYSTOLE AND DIASTOLE IN AN ISCHEMIA-REPERFUSION MODEL

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Background: Ischemia-induced mechanical dyssynchrony (MDys) of the left ventricle (LV) is a strong predictor of LV remodeling. We examined the effect of LV unloading by the intraaortic balloon pump (IABP), on mechanical synchronization of LV walls.

Methods: In 25 anesthetized, open chest pigs, instrumented with Millar pressure catheter and sonomicrometry crystals, ischemia was induced by ligation of the middle left anterior descending artery for 1 hour followed by 2 hour reperfusion. Crystals for circumferential motion tracking were placed as follows: a) pair 1: anterior-septal and anterior-lateral walls, b) pair 2: posterior-septal and posterior-lateral walls, in the middle of the long axis. For longitudinal axis: c) pair 3: apical and anterior-septal, d) pair 4: apical and posterior-lateral walls. The difference in time i) of peak shortening between pair 1-2(Dtmincirc) and between 3-4(Dtminlong) and ii) of peak lengthening (Dtmaxcirc and Dtmaxlong, respectively) were measured as systolic and diastolic mechanical synchronization indices. Data were recorded without and after 2 min of IABP support, at baseline, 30min of ischemia, 30min and 90min of reperfusion.

Results: After 30min of ischemia, systolic and diastolic MDys were evident in circumferential and longitudinal axis (Dtmincirc: 90±57 msec vs 27±57, p=0.001; Dtminlong : 49±76msec vs 13±34 , p=0.07; Dtmaxcirc: 66±52 vs. -1±36 msec, p<0.001; Dtmaxlong: 70±83 vs. -2±41 msec, p=0.004). During ischemia, there was a trend for reduction of systolic Dtmincirc (77±56 vs 86±54 msec, p=0.088) and a significant decrease of diastolic Dtmaxcirc by LV unloading (55±50 vs. 60±53 msec, p=0.022). During reperfusion, diastolic MDys was significantly improved by LV unloading (Dtmaxcirc: 70±33 msec vs 88±46, p=0.026, Dtmaxlong: 84±81 vs 98±94 msec, p=0.031).

Conclusions: MDys manifests early after onset of acute ischemia during both systole and diastole. Unloading by counterpulsation ameliorates systolic and especially diastolic MDys both in the circumferential as well as in the longitudinal (during reperfusion only) axis. This may constitute an additional mechanism of left ventricular functional improvement during IABP support.