Altered nano-order elasticity and crossbridge kinetics in failing myocardium

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Background: We hypothesized that cardiomyocyte stiffness in transverse direction is increased in hypertrophied hearts.

Methods and Results: Male Wistar rats received a vehicle (control), isoproterenol (ISO) or ISO+\textsuperscript{\beta}1-blocker metoprolol (MET) subcutaneously. After 7 days, compared with those in control and ISO+MET groups, ISO administration had increased left ventricular (LV) wall thickness (P<0.05), and increased LV end-diastolic pressure (P<0.05). Elasticity of living cardiomyocytes was measured by an atomic force microscope (AFM) \cite{1} (Fig A). Elasticity of cardiomyocytes was significantly higher in ISO group than in control and ISO + MET groups (Fig B). Butanedione monoxime (BDM), an inhibitor of actin-myosin interaction and blebbistatin, a specific myosin II inhibitor, significantly reduced the elasticity of cardiomyocytes in ISO group (Fig B). X-ray diffraction analysis\cite{2} revealed that intensity ratio ((1,0)/(1,1)) at diastole was significantly increased after BDM in ISO group (P<0.005), indicating that proportion of myosin heads in proximity to actin was reduced by BDM.

Conclusions: Cardiomyocyte stiffness in transverse direction was increased in hearts with ISO-induced hypertrophy. This is caused by incomplete relaxation.
Key words
Beta blocker, diastolic heart failure

Figure

References