

Abnormal vascular load relates to impaired relaxation in patients with Fontan circulation

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(Introduction) Today, Fontan procedure is the last staged operation for children who can not reach to two ventricle repair. To modify operation method, mortality rate in patients with a single ventricle are dramatically reduced. Therefore, a lot of Fontan patients are entering adulthood, and these patients are facing an uncertain future. Concretely, patients are prone to development of late -onset supraventricular tachyarrhythmias, heart failure, progressive rise of their pulmonary vascular resistances, protein losing enteropathy, hepatic dysfunction, pulmonary arteriovenous malformation, and so on.

Previous studies consistently demonstrated delayed relaxation in Fontan ventricle regardless of its systolic function. Mechanisms of delayed relaxation remain poorly understood. Relaxation is prolonged by acute increases in animals and human studies.

(Hypothesis) We hypothesized that abnormal loading, which also demonstrated previously, has an important mechanism of delayed relaxation in Fontan patients too. (Methods) Fifty-five patients with fontan circulation (Age 5.2 ± 3.9 , 0.5-15 years) underwent cardiac catheterization to check for residual pulmonary stenosis indicated by echocardiography. Impedance moduli were computed from Fourier components of pressure and flow data.

(Results)

Time constant of relaxation (τ) of hybrid logistic model was significantly increased in Fontan patients than in controls with small ventricular septal defects (21.9 vs 17.8, $P < 0.01$). Resistances were in proportion to τ , and strong correlation ($r = 0.71$). Reflect wave time, which were derived from fourth derivative of aorta pressure wave, were inversely with τ . ($r = 0.35$) Characteristic impedance were in proportion to τ , but weak correlation ($r = 0.49$). Compliances mean, PWV and LVP max did not have significant correlation.

Multivariate regression analysis have done. Resistance and wave reflection were correlated with prolonged τ . ($p < 0.05$)

(Conclusion) Abnormal ventricular systolic-afterload interaction, abnormal afterload profile has detrimental effects on ventricular relaxation in fontan circulation. Thus afterload modulation may be beneficial to improve long-term prognosis of patients with this circulation.