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Biophysical properties of the aorta, left ventricular properties and exercise capacity in obese adolescents

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We sought to determine whether childhood obesity is associated with increased aortic stiffness by measuring the biophysical properties of the aorta in obese children using a non-invasive echo-Doppler method. We also sought to determine if any changes were associated with exercise capacity. Increased aortic stiffness is a strong predictor of future cardiovascular events and mortality in adults. Obesity is known to be associated with increased aortic stiffness and arterial disease in adults. Vascular function has been shown to be abnormal in obese adolescents. We prospectively evaluated a cohort of obese children (N=63) and compared them to normal weight controls (N=55). Anthropometric data were recorded. Using an echo-Doppler method, pulse wave velocity (PWV), aortic input impedance (Zi), characteristic impedance (Zc), arterial pressure-strain elastic modulus (Ep), arterial wall stiffness index (β-index), and peak aortic velocity (PAoV) were calculated. We correlated our findings with lipid levels. We assessed left ventricular dimensions and standard measures of cardiac function. Cardiopulmonary exercise testing was performed on all obese children.Compared to normal-weight children, obese children have higher PWV, Zc, β-index, Ep and PAoV. Obese children had higher systolic blood pressure (BP) than normal-weight children but there was no difference in diastolic BP. LV dimensions and standard measures of cardiac systolic function were similar in the two groups while obese children had altered diastolic properties. Left ventricular (LV) mass was higher in obese children. There was no association between lipid levels and the biophysical properties of the aorta. Absolute oxygen consumption was 122% predicted while relative oxygen consumption was 68% predicted in obese children.

Measures of the biophysical properties of the aorta are already abnormal in obese children reflecting increased aortic stiffness at this early stage of disease. Obese children also have increased LV mass, altered diastolic properties and abnormal exercise capacity. PWV may be useful in monitoring progression of arterial disease or the effect of therapeutic interventions.

Biography

G Sandor is Emeritus Professor in the Department of Paediatrics, UBC, and Director of the Echolab, BC Children's Hospital. His interests are the non-invasive assessment of cardiac and vascular function in congenital and acquired paediatric cardiac disease.

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