Are organ size and heart rate advantageous measures for more precise clinical use of Velocity Time Integral in children?

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Introduction: Integration of doppler curves is an often used means of echocardiographic estimation of cardiac output. To compensate for maturational changes in children, physiological factors as heart rate, ventricular length and the Frank Starling mechanism have to be considered. Our aim was to create percentiles for aortic (VTIAo) and pulmonary velocity time integral (VTIPa) that are useful in clinical practice.

Methods: 377 echocardiographic datasets recorded in healthy children (0-20 years) were analysed. Measurement of left ventricular length, VTIAo (group I) respectively right ventricular length, VTIPa (group II) and heart rate (HR) was performed. To assess practicability 40 patients (0-6 years) with shunt lesions (group A: patent ductus arteriosus (PDA); group B: atrial septal defect (ASD)) were investigated and values integrated into the percentiles. Sensitivity of this method was compared to sensitivity of other reference values for VTIAo (C. Pees, Pediatr Cardiol (2013) 34: 1194-1200).

Results: Feasibility was 91% for group I (330 datasets: 166 male, 164 female) and 86% for group II (324 datasets: 164 male, 160 female). VTI/HR and ventricular length provided excellent correlations in children younger than 7 years (group I: r=0,824; group II: r=0,772). Adolescent individuals (7-20 years) showed lower correlation because of higher stroke volume variability (group I: male r=0,462, female r=0,458; group II: male r=0,521, female r=0,456). With the percentiles created more known aortic hyperperfusion (group A) could be detected (50% >2 standard deviation (SD); 100% >1 SD) than with reference data of C (35% > 2 SD; 50% > 1 SD). Sensitivity of percentiles for VTIPa (group B) was also satisfactory (65% > 2 SD; 90% > 1 SD).

Conclusions: These reference values might facilitate the differentiation between normal and pathological VTI especially in young children.