

Decreased cardiovascular function late after ventricular septal defect repair

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Introduction: Survival after ventricular septal defect (VSD) repair is excellent but in adulthood late residua including conduction disease, arrhythmia and heart failure are not uncommon. This study aims to evaluate cardiac function, heart rate variability, exercise capacity and physical activity in children late after VSD repair.

Methods: 28 patients after VSD repair and a healthy age-matched control group underwent an echocardiogram, maximal exercise test and 24h holter monitoring. Physical activity including physical education at school, regular biking/walking behavior and sports participation was mapped using a questionnaire.

Results: Age of the patients and controls ranged from 8-18y. Patients were operated at a mean of 1.7y and time after intervention was on average 10.1y. Right ventricular function, measured by Tissue Doppler Imaging was significantly less in patients compared to controls (S' : 0.11 ± 0.02 vs 0.12 ± 0.02 E' : 0.12 ± 0.04 vs 0.15 ± 0.03 A' : 0.06 ± 0.02 vs 0.09 ± 0.02 , all $p < 0.001$) and lower systolic function (S') was associated with physical activity ($R^2 = -0.166$; $p = 0.039$). Average strain in the apical long axis view was also lower in patients (-17.5 ± 3.4 vs -19.2 ± 3.7 , $p = 0.023$). Ejection fraction and stroke volume from 3D echocardiography were both lower in patients (47.1 ± 5.1 vs 51.3 ± 6.3 , $p = 0.002$ and 40.2 ± 20.2 vs 50.7 ± 14.3 , $p = 0.008$). Patients achieved a lower maximal power (130 ± 52 vs 152 ± 57 , $p = 0.023$) and maximal oxygen uptake (39.6 ± 6.7 vs 44.6 ± 7.3 , $p = 0.002$) in the exercise test and had a lower level of weekly physical activity compared to controls (37.8 vs 50.7 MET/week; $p = 0.028$). Heart rate was significantly higher during sleep in patients (70.5 ± 8.2 vs 65.9 ± 9.1 , $p = 0.023$). During the 24h recording, patients had more premature ventricular and atrial contractions (145 ± 464 vs 8 ± 33 , $p = 0.023$ and 2 ± 7 vs 1 ± 9 , $p = 0.016$). Heart rate variability analysis revealed a lower low frequency power (624 ± 447 vs 880 ± 615 $p = 0.049$) and lower standard deviation of interbeat intervals (61.3 ± 17.3 vs 78.1 ± 22.5 , $p = 0.001$) during physically active periods in patients.

Conclusions: 10 years after surgical correction of a VSD, cardiovascular function is decreased compared to healthy controls. This study shows that exercise capacity, cardiac function and heart rate variability are already decreased in childhood. Therefore, it is important to continue follow-up in patients after VSD repair into adulthood.