

## Increased heart rate variability in children with Fontan circulation and sinus node dysfunction

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### Introduction

Development of sinus node dysfunction (SND) causes significant morbidity in patients who have undergone Fontan surgery. Heart rate variability (HRV) is a marker of the autonomic nervous system regulation of the heart. HRV has been shown to be reduced in patients with Fontan circulation. Changes in HRV have been associated with tachyarrhythmia as well as SND in adult patients. We aimed to study whether changes in HRV could be detected in 24-hour electrocardiographic (ECG) recordings in Fontan patients with SND.

### Methods

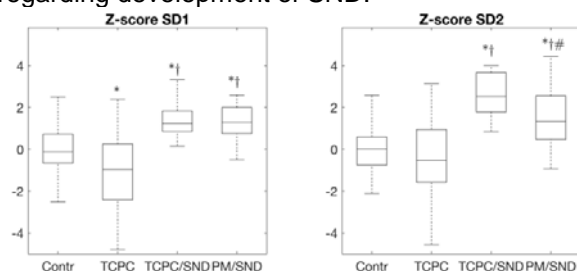
HRV from 24-hour ECGs was analyzed by Poincaré analysis where SD1 represents the magnitude of the beat-to-beat variability, and SD2 represents changes in mean RR. We compared HRV parameters using analysis of variance with groupwise t-tests as post-hoc tests: patients with Fontan circulation who later developed the need for a pacemaker due to severe SND (n=12), patients with Fontan circulation and SND but without indication for pacemaker treatment (n=11), patients with Fontan circulation without SND (n=90) and healthy controls (n=66).

### Results

Patients with Fontan circulation without SND had significantly lower SD1 than controls. Both SD1 and SD2 were significantly higher in the two SND groups compared with both healthy controls and patients with Fontan circulation without SND. SD2 was slightly reduced in SND patients with pacemaker compared to SND patients without pacemaker (p=0.06).

### Conclusions

As expected, patients with Fontan circulation showed lower HRV than healthy controls. When the patients develop SND the HRV increases and becomes significantly higher compared to healthy controls and Fontan patients without SND. However, SD2 tended to decrease again in SND patients with pacemaker, which could indicate a reduced diurnal variability in heart rate. This was a small study, but our results indicate that HRV analysis might be useful in the follow-up of Fontan patients regarding development of SND.



Poincaré indices presented as z-scores based on controls. Boxes represent median and interquartile range, whiskers show range. P-values were derived from post-hoc tests after analysis of variance.

\* p<0.05 versus controls. † p<0.05 versus TCPC. # p=0.06 TCPC/SND vs TCPC/PM /SND.

TCPC=total cavopulmonary connection, TCPC/SND= TCPC with SND, PM/SND=TCPC with SND and pacemaker.