

Effects of 24-hour-shift related short term sleep deprivation on cardiac function: a CMR based study

Friday 10:50-11:00 AM | SST02-03 | Room: E450A

PURPOSE

Sleep deprivation is known to increase blood pressure, inflammatory processes, and stress hormone secretion. This study sought to investigate the immediate effects of 24 hour shift associated sleep deprivation on radiologists.

METHOD AND MATERIALS

15 subjects (1, female, mean age 31.6 ± 2.1 years; mean EF 60.5%) were scanned on a clinical 1.5 T CMR scanner (Philips Ingenia) before and following a 24 hour shift with an average of 3 hours of sleep. In addition venous blood and urine samples were collected from all subjects and blood pressure (BP) as well as heart rate (HR) were measured. Short axis slices as well as horizontal long axis views were acquired using standard SSFP-sequences. Standard CMR parameters for left ventricular volumes, ejection fraction and wall thickness as well as Feature Tracking derived circumferential and longitudinal strain parameters were measured.

RESULTS

Following short term sleep deprivation (average sleep duration: 182 min) significant increases in systolic (pre: 112.6 ± 12.9 mm Hg; post: 118.5 ± 14.3 mm Hg; $p=0.017$) and diastolic BP (pre: 63.9 ± 12.3 mm Hg; post 71.5 ± 7.7 mm Hg, $p=0.021$), HR (pre: 66 ± 9.8 min⁻¹; post: 71.4 ± 11.6 min⁻¹; $p=0.002$) as well as peak systolic circumferential strain (PSCS; pre: $-22.3 \pm 2.4\%$; post: $-23.9 \pm 2.4\%$, $p=0.011$) and peak systolic longitudinal strain (PSLS; pre: $-21.4 \pm 1.9\% \cdot s^{-1}$, post: $-23.1 \pm 1.9\% \cdot s^{-1}$, $p=0.005$) were revealed. Additionally significant increases in cortisol (pre: 10.0 ± 4.4 µg/dl; post: 14.7 ± 5.7 µg/dl; $p=0.023$), TSH (pre: 1.6 ± 0.5 µU/ml, post: 2.7 ± 1.0 µU/ml; $p=0.002$) FT3 (pre: 3.1 ± 0.98 pg/ml, post: 3.4 ± 0.5 pg/ml; $p=0.039$) and FT4 (pre: 0.9 ± 0.1 ng/dl, post: 1.0 ± 0.1 ng/dl; $p=0.039$) levels were found. In contrast, left ventricular ejection fraction, noradrenalin, glucose and insulin levels were unchanged ($p = ns$).

CONCLUSION

For the first time it could be shown that 24 hour shift related short term sleep deprivation leads to a significant increase in cardiac contractility, blood pressure, heart rate and stress hormone secretion.

CLINICAL RELEVANCE/APPLICATION

The clinical relevance is not yet well understood, since these effects may only be short lived and should be further studied in a larger cohort.