Introduction:
In severe traumatic brain injury (TBI) the *heart rate variability* (HRV) could inform about severity and predict outcome. In this study we depicted the dynamic response of HRV to iatrogenic interventions.

Methods:
Prospectively collected high resolution data of patients from multiple centers with severe TBI from the Intensive Care Unit (ICU) cohort of the CENTER-TBI study were analyzed. Bad outcome was defined as having a Glasgow-Outcome-Scale GOSE between 1-3 at 6 months. HRV parameters were calculated according to international guidelines using a 5-minute sliding window, updated every 10s. Hourly and daily medians were further analyzed.

Results:
We included 273 patients (11403h analyzed). 80% were male, 46±19 years old and had an initial GCS of 6 (IQR 3-10). 72 had at least one unresponsive pupil. Outcome data was available for 90.1% of patients with 50.8% (N=125/246) having a bad outcome.

The ratio of LF (low frequency) to HF (high frequency) power (LF/HF ratio) was lower in patients with at least one unreactive pupil (1.2±1.1 vs. 1.5±1.3, p=0.03) and who had a bad outcome (1.1±0.9) vs. good outcome (1.8±1.4) (mean difference 0.69; 95%CI 0.38-0.99, p<0.001) suggesting parasympathetic dominance.

During deep sedation we found a lower LF/HF Ratio (0.9±1.1 vs. 1.6±1.7, p<0.001), a lower heart rate standard deviation (HR-SD) (p<0.001) and root mean square of successive differences heartbeats (RMSSD) (p=0.006), compared to patients that were not suppressed. During 151 sedation bolus the HR-SD increased (mean diff 0.71 95% CI 0.9-0.4, p<0.002) compared to baseline (30min before bolus).

During days with induced hypothermia (63d-mild hypothermia; 23d≤35°C, N=42) the LF/HF Ratio was lower (1.6±1.7 vs 1.1±1.1, p=0.02), as were the HR-SD (p=0.01) & RMSSD (p=0.01). Patients with a good outcome but not those with poor outcome showed increased RMSSD during suctioning (reflecting better vagal response).

Conclusion:
HRV reflects severity and ICU interventions. A dynamic analysis during interventions may offer prognostic information.
Figure 1. The patients with a good 6-month outcome (GOSE>3) after severe traumatic brain injury showed an increase in root mean square of successive differences between normal heartbeats (RMSSD) (compared to baseline 30-minutes before tracheal suctioning).