

Recovery Assessment of Open-heart Cardiac Surgery Patients Using Heart Rate Variability Parameters

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Surgical operation causes short-term stress changing the balance of the autonomic nervous system (ANS). The ANS activity can be assessed through heart rate variability (HRV). This work aims to evaluate the recovery process of open-heart cardiac surgery patients under two post-surgery physiotherapy techniques using HRV parameters. Ten-minute ECG recordings were performed on 17 open-heart cardiac surgery patients pre-operatively (PREOP) and during three post-operative days (POD1, POD2 and POD3). The recovery process was promoted using two different physiotherapy techniques: positive expiratory pressure (EP group, N = 9) and inspiratory training (IT group, N = 8). Common linear (SDNN and LF power) and non-linear (SD₁) HRV parameters were calculated for each patient. Statistical analyses inside and between the EP and IT groups were performed by depended and independent parametric or non-parametric tests.

The results show significant differences between HRV parameters pre- and post-operatively. Cross-subject averages of SDNN, LF and SD₁ in PREOP and POD1 for EP group recovery intervention were 36.46 and 18.07 ms, 636.08 and 42.84 ms², 21.06 and 5.89 ms, respectively and for IT group they were 32.05 and 19.66 ms, 283.31 and 73.18 ms², 13.69 and 8.98 ms, respectively. There was a reduction of all three investigated HRV parameters in the POD1 for both groups (e.g., for SDNN: p = 0.02 and 0.042 for EP and IT groups, respectively). LF power average values from POD1 to POD3 had an increase from 42.84 to 159.46 ms² and 73.18 to 119.02 ms² for the EP and IT groups, respectively, indicating that patients were eventually being recovered from the surgery. Statistically significant difference between EP and IT interventions were not discovered (e.g., p = 0.54 for SDNN, PREOP vs. POD3). Based on the results, all studied HRV parameters are potential indicators of the short-term recovery after cardiac surgery.

Cross-subject average values of SDNN [ms], LF power [ms²] and SD₁ [ms] for groups EP (N = 9) and IT (N = 8)

	EP	IT	EP	IT	EP	IT	EP	IT
	PREOP	PREOP	POD1	POD1	POD2	POD2	POD3	POD3
SDNN	36.46	32.05	18.07	19.66	16.89	18.27	18.24	19.37
LF	636.08	283.31	42.84	73.18	56.1	177.9	159.4	119
SD ₁	21.06	13.69	5.89	8.98	6.85	10.43	10.62	9.48