

ORAL PRESENTATION

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Multifractality of the heartbeat dynamics after beating heart myocardial revascularization

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Background

Recent studies suggest that time series of healthy human interbeat intervals belong to a special class of bio-signals displaying multifractal properties. The breakdown of multifractality was observed in congestive heart failure and angina pectoris; however, there has been no attempt to evaluate multifractal behavior before and after beating heart myocardial revascularization (off-pump CABG).

Methods

Sixty consecutive patients with isolated multivessel coronary artery disease scheduled for off-pump CABG were included in the study. Twenty-four hour Holter recordings were performed preoperatively and on the seventh postoperative day. Multifractal properties of the RR data set were determined for both, day- (12:00h to 18:00h) and night-time (00:00h to 06:00h) periods of the ECG recordings containing at least 95% of pure sinus rhythm. Multifractal spectrum τ at $q=3$ ($\tau(q=3)$), the peak position of the singularity spectrum (h_{top}) and the width of the singularity spectrum (Δh) were calculated by wavelet modulus maxima method as proposed by Ivanov et al. Mean differences over time were tested using paired-samples t-test. Results are reported as mean \pm SE; $p < 0.05$ or less was considered significant.

Results

Preoperatively, $\tau(q=3)$ was -0.52 ± 0.18 and -0.49 ± 0.17 , h_{top} 0.20 ± 0.07 and 0.15 ± 0.07 and Δh 0.31 ± 0.14 and 0.71 ± 0.14 for day-time and night-time period, respectively. Postoperatively, $\tau(q=3)$ was significantly higher for day-time period (-0.43 ± 0.23 , $p=0.015$), whereas h_{top} and Δh were significantly higher for both, day- and

night-time periods (0.25 ± 0.07 , $p < 0.001$ and 0.19 ± 0.06 , $p=0.002$ for h_{top} and 0.41 ± 0.20 and 0.31 ± 0.19 for Δh , respectively).

Conclusions

Significant postoperative increase of all multifractal parameters, except of $\tau(q=3)$ for night-time periods, clearly indicates that a marked breakdown of multifractal behavior into monofractal can be observed following off-pump CABG, indicating that multifractality is mostly governed by vagal activity.

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